ID: 38081724

Box 2
Loose
Item 2-140

National Resources Inventory (NRI)

Colorado Pilot Test 1997-1998

HANDBOOK

1997

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INTRODUCTION

The Federal Land Policy and Management Act and the Public Rangeland Improvements Act mandate that BLM complete a resource inventory of the public lands to include rangeland condition. In resent years rangeland condition has been a national issue. Although there have been several effort over the past twenty year to develop a national inventory, none have been universally excepted or economically feasible. The National Resource Inventory is a statistically designed inventory that could provide a solution to the legislative mandates of congress. The Colorado NRI test pilot is intended to determine if this sampling protocol will provide the information needed by BLM. It will also be evaluated to determine it's economic and logistic feasibility for adoption bureau wide.

BACKGROUND. The National Resources Inventory (NRI) is a tabulation of natural resource characteristics on rural land throughout the United States. Until 1997 NRI was completed only on non-Federal lands. This inventory captures information on land cover and use, soil erosion, wetlands, habitat diversity, conservation practices, and related resource attributes at over 800,000 random sample sites in all 50 states, Puerto Rico, Guam, and the U. S. Virgin Islands.

The NRI provides a record of trends in the Nation's resources over time and documents conservation accomplishments as well. Because the NRI is based on recognized statistical sampling methods and is scientifically designed and executed, NRI data are statistically reliable for national, regional, and state analyses. Information derived from the NRI is used by natural resource managers; policy makers and analysts; consultants; the media; other Federal agencies; state governments; universities; environmental, commodity, and farm groups; and the American public.

HISTORY. For over 60 years, the Natural Resources Conservation Service, has conducted periodic inventories of the Nation's soil, water, and related resources. The earliest efforts were reconnaissance studies in 1934. Subsequent inventories were completed in 1945, 1958, and 1967. The Rural Development Act of 1972 led to the institution of the National Resources Inventory. It implemented inventory and monitoring activities to assess the status, conditions, and trends of resources at 5-year intervals. The first NRI was undertaken in 1977, and subsequent inventories were made in 1982, 1987, and 1992.

DATA COLLECTION, STORAGE AND ANALYSIS. Personal Digital Assistants (PDA). When available, resource data collection will be accomplished using Apple's Newton MessagePads. These PDA's will replace the expensive, time-consuming procedure of data entry via paper worksheets. PDA's are small, hand-held, portable appliances with a pen or stylus that will serve as "digital worksheets". Data recording is performed on the PDA with a touch pad which allows the user to select from a choice list or to write a number or word. Since they are usable at remote field sites and have editing

capabilities, erroneous entries can be immediately detected and easily corrected. The software automatically determines which inventory questions should be answered, whether the answers are compatible and consistent, and which questions can be made invisible or "locked" as a result of previous responses. Because the flow is question controlled, there is no ambiguity; omissions are almost impossible and material that does not pertain is not displayed.

Notes. The PDA software allows for a minimum of one note to be recorded for each data element. The note is associated with the data element and can be used to explain unusual situations. During the edit and review processes, notes will be helpful in interpreting data entries. Notes become a part of the NRI database and are valuable for future inventories.

After data collection is complete, the results can be up-loaded via a modem directly to the Iowa State University Statistical Laboratory.

Worksheets. It is anticipated that the PDAs will not be available for use during the initial stages of the Colorado test pilot due to constraints in programing. Therefore, data will be collected on paper worksheets. These worksheets have been designed so that when the PDAs are available data can be easily entered.

Iowa State University Statistical Laboratory. Iowa State University Statistical Laboratory has established a data base server that will store and analyze NRI data. They have also selected the locations of the primary sampling units (PSU's) for the 1997 NRI.

INFORMATION SOURCES. The following reference materials may be need for use as ancillary information;

* Land Use History
* List of Noxious Weeds
* List of T&E Species
* Contact Landowners
* Colorado MLRA Map
* Range Site List/#
*Compilation of Range Site Descriptions (for crew) with local adjustments if they have been made
* Wetland Cowardin system Pub. FWS-obs-79-31, Dec 1979
* Nat'l Soil Handbook Sec.603 8000 Series Code
* Check list for Log Book
* Topo Maps
* Soil Map w/soil desc./soil survey/hydric soils list
* Rangeland ecological Site Desc.
* Plant List
* Plant Books
* Aerial Photos w/Index
* Folder w/ Index
* Land Ownership
* Competing Soils Series Info Sheet
* BLM map w/ Route to PSU
* Air Dry Weight Table
* Production Tables- Juniper
* Growth Curves
* Other reference Books
* Coordinate with ranchers
* Livestock (current use, historical use)

DATA COLLECTION PROCESS

PRIMARY SAMPLING UNITS. Resource data collected for The National Resource Inventory is completed on land called Primary Sampling Units (PSU). PSUs are square to rectangular tracts of land approximately typically 160 acres (PSUs in other parts of the USA could be 40, 100, or 640 acres). Some important resource conditions occur as small areas with linear features or posses unique patterns. These types of data are collected on the entire PSU. Most of the resource data is collected to represent a sample point and a small area associated with that point. The typical NRI Primary Sampling Units consists of three sampling points. For the Colorado NRI test pilot, data will collected on only two sample points.

LOCATE PRIMARY SAMPLE UNIT POINT. Use a Global Position System (G.P.S.) machine to locate the point. See Appendix A Precise Lightweight GPS receivers (PLGR) Abridged User's Guide.

PHOTOGRAPH THE SITE. A minimum of 4 photographs will be taken at each site. A general view photograph will be taken from the south and east end of Transects 1 and 2, respectively (Figure 3). These photographs should be taken 15 feet beyond the end of each transect with the measuring tape centered in the photo. If possible, the end point of the transect and some skyline should be included in these two photographs. In addition, these and all other photographs should include, at a minimum, a photo identification card that includes a PSU number (including Site 1 or 2), and date. This card should be placed close enough to the camera to insure that the numbers are readable in the photograph.

The third photograph is a closeup of the point where the two transects cross the point. This photograph is taken 15 ft south of the point on Transect 1 with the point centered in the photograph. If a shrub or tree obscures the point, document and move the photograph to one of the other 3 quarters of the transects and document the change.

The fourth photograph is a closeup of the soil profile in the pit. It should be taken with the sunlight hitting the face of the pit. Use a flash if light conditions are marginal. Other photographs of special site characteristics are encouraged to document anomalies. All optional photographs should include the photo identification card and a written explanation of what is in the photo. Examples of optional photograph subjects include weed invasions, rare plant species, plant disease, production plot closeups, etc.

Crews that took the photos are responsible for filing the photographs in the proper study file. Negatives should be kept with the photos.

Illustration 1

PSU NUMBER

SITE NUMBER

DATE

PHOTO NUMBER

LOGBOOK. Each crew should maintain a logbook of the events that occur during this NRI test pilot. Information from these logs will help the technical team and managers evaluate this pilot.

The following are items that should be recorded in the logbook:

1. Operational/Logistical findings. The amount of time it takes to:

   a. Preparation time

   b. Navigating to the PSU and sampling points

   c. Other factors weather events, insect problems, etc.

2. Data Collection (Times)

   a. soil verification and quality

   b. production data

   c. canopy/basal cover

   d. soil surface characterization

   e. rangeland health, weeds, and special status plants, etc.

3. Problems or matters of concern or interest. Observations on grasshoppers, rabbits, special weather event (did it recently rain), general plant phenology, and any other matter of interest.

QUALITY CONTROL. To provide some measure of consistency in data collection and overall quality control of the data, the following procedures will be incorporated into the protocol.

(1) For estimating the production of plant species using weight units and weight unit weights, the Double Sampling Method will be used on the first point of the first day, each week.

(2) One scheduled day each month, two NRI crews will meet on a PSU and sample the points using a flip flop method. The crews will be designated as Team A and Team B. While team A is collecting data on Point 1 (identified as Pt. 1a data), Team B is collecting the data on Point 2 (identified as Pt. 2b data). Leaving the tapes and pins in place, the Teams then flip-flop so that Team A goes to Point 2 and collects data identified as Pt. 2a data, while Team B collects the data on

Point 1 identified as Pt. 1b data. Thus, Team A completes data sheets 1a and 2a for all protocols, and Team B completes data sheets 1b and 2b for all protocols. All protocols include the Soils data (classification and verification, soil quality, samples, etc.), Production data, Cover data, Tree data (if appropriate), and Rangeland Health Assessment. The only protocol not duplicated is the photo's taken at each point. The Team (crew) that begins the first data collection on the point is responsible for taking the required photo at that point.

(3) Members of the Technical Team will periodically accompany the crews to points within the PSU, observing and assisting crew members in collecting the data.

(4) To eliminate potential errors from manual mathematically computation, the Iowa State University (ISU) computer program will be designed to perform these computations.

(5) Prior to sending copies of the field collection data forms to ISU for data entry, all forms will be reviewed for legibility, completeness, and accuracy. It is anticipated that initial data runs on the ISU computer program will identify errors that can and will be corrected.

(6) To assist crew members with any questions that might arise while on site, cellular phones and radios have been provided so they can contact a member of the technical team for advise and clarification.

GENERAL DATA COLLECTION REQUIREMENTS. For the purpose of this pilot project crews will be expected to collect and gather data which will be used as the basis for evaluating NRI for Bureau wide application. Seven basic types of data will be gathered for the Primary sample Unit (PSU) and at each sampling point. These types are:

1) PSU AND SAMPLE POINT DATA - includes recorders names, land status, information on farmsteads, rural transportation, and water bodies, location of the points (latitude, and longitude), land cover and uses, forest types, wetland designations, and conservation practices.

2) SOILS DATA - includes verification and documentation of pit, collection of samples, and soil health samples and documentation.

3) COVER DATA - used for providing trending attributes

4) DOMINATE VEGETATION HEIGHT - used for providing trending relating to wildlife habitat, structural diversity snow entrapment and control of soil erosion.

5) VEGETATION PRODUCTION DATA - used to determine similarity index on rangeland, used for information on forest land

6) RANGELAND HEALTH ASSESSMENT - used to assess health

7) RANGELAND (SPECIFIC TO PINYON - JUNIPER SPECIES) AND FOREST LAND CHARACTERIZATION - used to provide resource information on tree species

TYPES OF DATA TO COLLECT. In locating the sampling points within a PSU, crews will be faced with determining what type(s) of data to gather at that particular location, as well as what to do in certain situations that relate to encountering land forms, natural or man-caused disturbances, etc. This section has been developed to provide crews with the guidance and direction needed to answer these questions, and for the consistency between crews.

TYPE OF LAND (see glossary of terms)	TYPES OF DATA TO COLLECT (see types above)
RANGELAND[1]	TYPES 1,2,3,4,5,6 & TYPE 7 (IF TREES EXIST)
RANGELAND[2]	TYPES 1,2,3,4,5,6, AND 7
FOREST LAND[3]	TYPES 1,2,3,4,5 AND 7

If point hits on private, U.S. Forest Service, State, or other Federal ownership (non-BLM), enter the appropriate Land Ownership code, on the point data form and proceed to the next point. Do not collect any other data.

If point hits on a Build-Up area or land form identified as land use codes 611 - 620, 700, 730, and 911 - 920, enter the appropriate codes, on the point data form and proceed to the next point. Do not collect any other data.

If point hits on Rangeland or Forest land identified as Land Use codes 250, 251, 252, and 340 lay out the plot design and collect the types of data indicated in the chart above. If one or more of the sampling plots with the 150 ft diameter plot

---

[1] land use codes 250, and 252

[2] land use code 251

[3] land use code 340, forest type groups 11, 13, 15, 17, 19, 20, 21, and 22

design fall within another ecological site (identified by an abrupt change in soil - vegetation), sample both ecological sites separately.

HOWEVER IF:

One or more of the sampling plots with the 150 ft diameter plot design fall within a natural land form, or disturbance (trails or 2 track road, fire, disease, insect damage, etc.), the plot(s) should be considered as part of or representative of the larger 150 ft dia. macro-plot and resource data (if available) be recorded.

One or more of the sampling plots with the 150 ft diameter plot design fall within a man caused disturbance (improved road, drill pad, terracing, mining claim assessment work, right-of-way clearance, etc.) the plot(s) should not be considered as part of or representative of the larger 150 ft dia. macro-plot, and additional plots on the opposite end of the affected transect be added and resource data be recorded.

One or more of the sampling plots with the 150 ft diameter plot design fall within a man caused disturbance or manipulation such as a vegetation treatment project (plowing, seeding, spraying, chaining, etc), the plot(s) should be considered as an altered site and data collected and recorded as if 2 ecological sites occur on the larger 150 ft dia. macro-plot.

PRIMARY SAMPLING UNIT DATA (Illustration 2) Record the following

-Recorders Name
-Date
-Land Status. Indicate the land status category that most nearly fit the status for the entire Primary Sampling unit.

Land Status Category
Entirely BLM
Partially BLM; Entirely Federal
*Entirely Federal; no BLM
Mixture of BLM; with Private or State
*Entirely Private/State
*Mixture of Private/State & Other Federal
*Other; list in notes section

*These categories do not require the collection of additional data

-Development Areas. Use maps and aerial photos to determine the size of farmsteads, ranch headquarters, Urban and Build-up, and rural transportation areas.

Illustration 2

Colorado BLM 1997
Test Pilot Worksheet

PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _ _ _

Page 1

PSU DATA, General Information

Data Gathers

Last Name	**First Name**

Land status

Entirely BLM	**01**	
Partially BLM; Entirely Federal	**02**	
***Entirely Federal; no BLM**	**03**	
Mixture of BLM; with Private or State	**04**	
***Entirely Private/State**	**05**	
***Mixture of Private/State & Other Federal**	**06**	
***Other; list in notes section**	**07**	

* don't collect additional data!

Notes: Record notes here, including comments regarding PSU location (up to 300 Characters);_____

PSU DEVELOPMENT AREAS: use maps and aerial photos to determine; don't spend more than 15 minutes.

1. Farmsteads and Ranch Headquarters; Areas Within PSU	to Nearest 0.1 Acre	.
2. Urban and Build-up Areas, 0.25-10 Acres in Size Areas Within PSU	to Nearest 0.1 Acre	.
3. Urban and Build-up Areas, 10 or Greater Acres in Size Areas Within PSU	to Nearest 1 Acre	
4. Rural Transportation - Improved/maintained Roads Includes ditches and other disturbances associated with the construction of the road.	- Length Within PSU, to Nearest 0.1 Mile	.
	- Average Width of Disturbance in Feet	
5. Rural Transportation - Unimproved Natural Surface Roads	- Length Within PSU, to Nearest 0.1 Mile	.
	- Average Width of Disturbance in Feet	
6. Rural Transportation - Railroads	- Length Within PSU, to Nearest 0.1 Mile	.
	- Average Width of Disturbance in Feet	

Rural Transportation--areas of roads (Illustration 2). Record the type of roads that occur on the PSU, the number of miles by type and the width disturbed area or right of way.

Improved/maintained. These are roads that are developed and maintained with mechanized equipment. This will include paved roads, graveled surface roads that are maintained on a selected basis with mechanized equipment. Typically, they are classified on topographic maps as "medium-duty" or "light-duty". Roads that are in BLM or US Forest Service transportation systems that are mechanically maintained (e.g. graded, graveled, etc) also would be considered in this category.

Unimproved Natural Surface roads. These are roads that are not developed and maintained with mechanized equipment. Typically, they are classified on topographic maps as "Unimproved dirt". Roads that are in BLM or US Forest Service transportation systems that are not mechanically maintained (e.g. graded, graveled, etc) would also be considered in this category. Roads that don't appear on any map would be in this category.

Railroads

-Sketch the PSU. Sketch the PSU showing farmsteads and ranch headquarters, urban buildup, rural transportation, streams, and waterbodies. Show any other important features such as power poles. Show location of points. This procedure can be accomplished by enlarging a copy of the topographic map to a minimum of 200%. Be sure to indicate Township, Range, and Meridian.

-Water Areas. Indicate the size and kind of water (streams or water bodies) if it occurs in the PSU.

Large Streams. Indicate the size of the area to the nearest acre for each stream that is at least 1/8 mile wide. If there are two separate streams indicate the area of each by segment number.

Small streams. Indicate the width (feet) and the Length of each stream (segment) that is less than 1/8 mile wide.

Large Water Bodies. Indicate the kind of water body, size class and size of area to the nearest acre for each water bodies that are at least 40 acres.

Kind	Size Class
1. Reservoir	1. Small < 100 acres
2. Lake	2. Medium 100-1,000 acres
	3. Large > 1,000

Illustration 3

Colorado BLM 1997
Test Pilot Worksheet **PSU NUMBER**_ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Page 2

PSU SKETCH

Sketch the PSU showing farmsteads and ranch headquarters, urban buildup, rural transportation, streams, and waterbodies. Show any other important features such as power poles. Show location of points. This procedure can be accomplished by enlarging a copy of the topographic map to a minimum of 200%. Be sure to indicate Township, Range, and Meridian.

Small Water Bodies. For water bodies that are less than 40 acres, Indicate the total size of the water body including the area out side the PSU to the nearest 0.1 acre, the size of the water body within the PSU to the nearest 0.1 acre and the kind of water body.

Kind

1. Natural
2. Constructed
3. Undetermined

POINT DATA (Illustration 4) Record the following:

-Random Latitude and Longitude are values entered into the Global Position System (G.P.S.) machine to locate the point.

-Latitude and Longitude at the Point. After the point has been located the (G.P.S.) machine is left running for 30 minutes after which time the Latitude and Longitude are read and recorded. This should improve the accuracy in relocating the point.

-Ownership. Indicate whether the land ownership of the point is BLM, U.S. Forest Service, Private or other.

-Land Cover/ Use. Enter the code for land cover/use

250 Rangeland (ecological site description is available)
251 Rangeland - Pinyon-juniper (ecological site description is available)
252 Rangeland - Oak (ecological site description is available)
340 Forest Land (no ecological site description is available)

Barren land
611 Salt Flats
612 Bare Exposed Rock
613 Stripe Mine Quarries
614 Beaches
615 Sand Dunes
616 Mixed Barren Lands
617 Mud Flats
618 River Wash
619 Oil Waste Land
620 Other Barren Land
Other codes
700 Urban and build-up areas 10 acres or larger
730 Small Urban and buildup areas .25 to 1 acre

Illustration 4

Colorado BLM 1997
Test Pilot Worksheet

PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Page 3

PSU DATA, General Information

	Segment 1	Segment 2
1 Large Streams (at least 1/8 mile wide) - Area within PSU, to nearest acre		

2. Small Stream (less than 1/8 mile wide) Use local area contacts to determine widths.
Linear length can be estimated from topographic maps.

Stream	Width (feet)	Length within PSU (feet)	Stream	Width (feet)	Length within PSU (feet)
Segment 1			Segment 5		
Segment 2			Segment 6		
Segment 3			Segment 7		
Segment 4			Segment 8		

3. Large-Water bodies with at least 40 acres in total size

Waterbodies	Kind	Size Class, Total	Size Within PSU (nearest acre)
1			
2			

Kind
1. Reservoir
2. Lake

Size Class
1. Small < 100 acres
2. Medium 100-1,000 acres
3. Large > 1,000

4. Small-Waterbodies less than 40 acres in total size

Waterbodies	Total Size to Nearest 0.1 Acre	Size Within PSU to Nearest 0.1 Acre	Kind
1	.	.	
2	.	.	
3	.	.	
4	.	.	

Kind
1. Natural
2. Constructed
3. Undetermined

Water bodies and streams
911 waterbody 2 to 40 acres
902 waterbody less than 2 acres
911 perennial stream less than 66 feet wide
912 perennial stream 66 to 660 feet wide
913 perennial stream less than 1/8 mile

-Forest Type Group. If the land cover /use code is 340, the examiner must indicate the forest type group.

11 Douglas Fir - Forest types in which Douglas Fir comprise a plurality of the cover. Common associated species include Western hemlock, Western Redcedar, the true firs, Redwood, Ponderosa Pine, and Larch.

13 Ponderosa Pine - Forest types in which Ponderosa Pine comprise a plurality of the cover. Common associated species include Jeffery Pine, Arizona Pine, Apache Pine, Chihuahua pine, Douglas-fir, Incense-cedar, and White Fir.

15 Lodgepole Pine - Forest types in which Lodgepole Pine comprise a plurality of the cover. Common associated species include Alpine-fir, western white pine, Engleman spruce, Aspen and Larch.

17 Fir-Spruce - Forest types in which true firs, Engelman spruce or Colorado Blue Spruce comprise a plurality of the cover. Common associated species include Mountain Hemlock and Lodgepole Pine. Alaskan Spruce types are included in this type.

19 Noncommercial - This type includes forest types that have little or no commercial wood value. Species such as bristile cone, coulter, digger, knobcone, limber, and white bark pines.

20 Western Hardwood - Forest types in which other western hardwoods such as red alder, big-leaf maple, and cottonwood comprise a plurality of the cover.

21 Pinyon/Juniper - Forest and woodlands in which Singleleaf pinyon Colorado pinyon and Utah Juniper comprise a plurality of the cover (i.e. greater than 10% canopy cover and there is <u>no</u> rangeland ecological site description). Other common associates include Mexican pinyon, Pary pinon, Alligator juniper, Oneseed juniper, Rocky Mountain juniper, Arizona cypress and species of cerocarpus.

22 Aspen - Forest types in which Aspen comprise a plurality of the cover.

Illustration 5
Colorado BLM 1997
Test Pilot Worksheet

PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _ _ _

Page 4

Point Number

Last Name	First Name

POINT DATA
Ownership, Use, Wetlands
& Conservation Practices

DATE: _ _/_ _/1997

1. Random Latitude		
2. Random Longitude		
3. Latitude at the point		
4. Longitude at the point		
5. Ownership indicate with X		
BLM	01	
*USFS	02	
*Private	03	
*Other	04	
6. Land Cover/Use Code		
7. Forest Type Group Code		
8. Does Point Fall on Wetland or Deepwater Habitat (Indicate with x)	No -Neither 01	
	Wetland 02	
	Deepwater Habitat 03	
9. Cowardin System Code 30 Riverine 40 Lacustrine		
10. Size of Wetland Basin Code	<1 acre 01	
	1-5 acre 02	
	5-20 acres 03	
	> 20 acres 04	

* If the point occurs on these lands don't collect additional data

6. Land Cover/Use Codes
250 Rangeland (ecological site description is available)
251 Rangeland - Pinyon-juniper (ecological site description is available)
252 Rangeland - Oak (ecological site description is available)
340 Forest Land (no ecological site description is available)
Barren Land Codes
611 Salt Flats
612 Bare Exposed Rock
613 Stripe Mine Quarries
614 Beaches
615 Sand Dunes
616 Mixed Barren Lands
617 Mud Flats
618 River Wash
619 Oil Waste Land
620 Other Barren Land
Other codes
700 Urban and build-up areas 10 acres or larger
730 Small Urban and buildup areas .25 to 1 acre

911 Waterbody 2 to 40 Acres
902 Waterbody less than 2 Acres
911 Perennial Stream less than 66 Feet Wide
912 Perennial Stream 66 to 660 Feet Wide
913 Perennial Stream less than 1/8 Mile

7. Forest Type Group Codes
11 Douglas Fir
13 Ponderosa Pine
15 Lodgepole Pine
17 Fir-Spruce in this type
19 Noncommercial
20 Western Hardwood
21 Pinyon/Juniper
22 Aspen

Conservation practices – Indicate all that are appropriate with X

None of the following	00		Sprayed	07		Planned Grazing Use	14	
Plowed	01		Burned	08		Bank Stabilization	15	
Chained	02		Seeded	09		Habitat Improvement (fishery)	16	
Chopped	03		Clear-cut	10		Diversion	17	
Terraced	04		Selective Harvested	11		Activity/Management Plan	18	
Pitted	05		Planted (trees)	12				
Furrowed	06		Fenced	13				

-Wetlands Data

Cowardin System (Illustration 5) The only system found in Colorado are 30 Riverine and 40 lacustrine

10	Marine	- includes the open ocean overlaying the continental shelf and its associated high-energy coastline.
20	Estuarine	- includes deep water tidal habitat that are semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land.
30	Riverine	- includes all wetlands and deepwater habitat contained within a channel except for wetlands dominated by tree, shrubs persistent emergents, emergent mosses, or lichens and habitats with water containing ocean-derived salts in excess 0.5%
40	Lacustrine	- includes wetland and deepwater habitats that; are situated on a topographic depression or a damned river channel, lack trees, shrubs, persistent emergents, emergent mosses, or lichens with greater than 30% areal coverage, and total area exceeds 8 hectare (20 acres.)
50	Palustrine	- includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5%

-Conservation Practices. Specific treatments used to meet a specific need in planning and carrying out soil and water conservation programs.

None of the following	Selective Harvest
Plowed	Planted
Chained	Fenced
Chopped	Planned Grazing Use
Terrace	Bank Stabilization
Pitted	Habitat Improvement
Furrowed	Diversion
Sprayed	Activity/management Plans
Burned	
Seeded	
Clear-cut	

Illustration 6
Colorado BLM 1997
Test Pilot Worksheet

PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _ _

POINT NUMBER ☐

Page 5

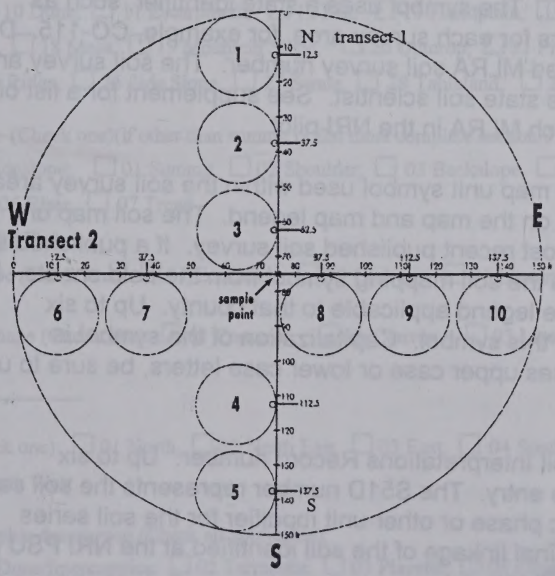
ECOLOGICAL SITES

Ecological site 1 (at point) Name _____
Number _____

Does any portion of either transect fall on a different ecological site. Yes ☐ No ☐

If yes draw a sketch showing the location of the boundary, the name of the sites, the location of transect extensions, the location of soil pits, the location of additional plots, and any other important features.

Ecological site 2 Name _____
Number _____



SOILS DATA (Illustration 7)

NOTE: Portions of the following were taken from the NRLS "NRI Soil Quality Pilot Study Data Collection Instructions Draft 4/30/96," with additions and modifications to accommodate the Colorado Pilot NRI Rangeland Health Test. All Soil Quality information will be collected and entered into the Apple MessagePad 120 (Newton).

SPECIFIC POINT AND PROXIMITY AREA DEFINITION AND REPRESENTATION - Soil identification and verification for the specific point and proximity will be done 4 meters from the GPS point and in the northeast quadrant of the Rangeland transect, 45 degrees east of the north transect line and is known as site 1 (see figure 1). When the range sampling protocol crosses into a contrasting soil that produces a different range site (ecological site), the contrasting soil identification and verification will be done at the extreme end of the range transect that extends into the contrasting unit and will be identified as site 2 (see figure 2). The complete documentation process and primary soil sampling will be conducted on the additional soil component.

SOIL IDENTIFICATION AND VERIFICATION - Identify and verify the soil at the point with a brief profile description from a mini-soil pit and auger hole.

Soil survey area symbol is a unique five-character alpha numeric symbol that identifies all soil survey areas. The number is available in the National Soil Information System (NASIS). The symbol uses a state identifier, such as Colorado and three numbers for each survey area, for example, CO-115. Do not use the more broadly defined MLRA soil survey number. The soil survey area symbol is available from the state soil scientist. See supplement for a list of soil survey area symbols for each MLRA in the NRI pilot.

Soil map unit symbol is the map unit symbol used within the soil survey area to identify the soil delineation on the map and map legend. The soil map unit symbol is taken from the most recent published soil survey. If a published soil survey is not available, use the soil mapping symbol from the field sheets. If the area is not mapped, use the legend applicable to that county. Up to six characters can be used for this symbol. Capitalization of the symbol is important. If the symbol uses upper case or lower case letters, be sure to use them.

S51D is the SCS-SOI-5 Soil Interpretations Record number. Up to six characters are used for the entry. The S51D number represents the soil series and accompanying specific phase or other unit modifier for the soil series identified. It provides the final linkage of the soil identified at the NRI PSU point to the soil information data base.

Illustration 7

Colorado BLM 1997
Test Pilot Worksheet

PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _ _ _

Page 6

POINT NUMBER ☐ **SITE 1 or 2 (CIRCLE)**

SOILS DATA
BACKGROUND INFORMATION

Soil Survey Area Symbol _ _ _ _ _ _ Soil Map Unit Symbol _ _ _ _ _ _ _ S5ID _ _ _ _ _ _ _

Soil Taxanomic Classification_____

Enter soil taxonomix classifcation if soil series S5ID is not entered.

Soil Component Name (60Characters)_____

☐ 01Named Map Unit Component, ☐ 02 Named Inclusion, ☐ 03 Unnamed Inclusion

Ecological Site Number_____ Ecological Site Name_____

☐ 01 Fits the Ecological Site Description, ☐ 02 Marginally Fits the Site Description, ☐ 03 Does Not Fit the Site Description

SETTING

1. Elevation (feet): _____
2. Mean Annual Precipitation (Range in inches)_____to_____
3. Frost Free Period (Range in days)_____to_____
4. Landform (Check one)

☐ 01 Badland, ☐ 02 Basin, ☐ 03 Bench (structural), ☐ 04 Breaks, ☐ 05 Bluffs, ☐ 06 Butte, ☐ 07 Cliff, ☐ 08 Cove, ☐ 09 Cuesta , ☐ 10 Dune, ☐ 11 Escarpment, ☐ 12 Fan, ☐ 13 Floodplain, ☐ 14 Hill-hillslope, ☐ 15 Hogback, ☐ 16 Knoll, ☐ 17 Marsh/Bog, ☐ 18 Mesa, ☐ 19 Mountain Slope, ☐ 20 Outcrop, ☐ 21 Piedimont, ☐ 22 Plain, ☐ 23 Plateau, ☐ 24 Playa, ☐ 25 Ridge, ☐ 26 Side Slope, ☐ 27 Swale, ☐ 28 Tableland, ☐ 29 Terrace, ☐ 30 Wash, ☐ 31 Other_____

5. Landscape Position (Check one)(if other than summit or flat must complete section 9 below)

Hillslope and Sideslope: ☐ 01 Summit, ☐ 02 Shoulder, ☐ 03 Backslope, ☐ 04 Footslope, ☐ 05 Toeslope

Terrace: ☐ 06 Riser, ☐ 07 Tread

Flat: ☐ 08 Flat

6. Vertical Slope Shape (Check one): ☐ 01 Concave ☐ 02 Convex ☐ 03 Linear

7. Horizontal Slope Shape (Check one): ☐ 01 Concave ☐02 Convex ☐ 03 Linear

8. Slope gradient (%)_____

9. Slope Aspect (Check one): ☐ 01 North, ☐ 02 North East, ☐ 03 East, ☐ 04 South East, ☐ 05 South, ☐ 06 South West, ☐ 07 West, ☐ 08 North West

10. Plot microtopographic description (Check all applicable):

☐ 01 Shrub-Coppice Dune/Intercoppice, ☐ 02 Terracette, ☐ 03 Playette, ☐ 05 Other_____

11. Soil pit microtopographic position (Check one):

☐ 01 Shrub-Coppice Dune, ☐ 02 Coppice bench, ☐ 03 Intercoppice, ☐ 04 Terracette, ☐ 05 Playette, ☐ 07 Other_____

12. Soil pit surface cover (Check one): ☐ 01 Bare, ☐ 02 Litter, ☐ 03 Cryptogam (moss/lichen), ☐ 04 Grass, ☐ 05 Shrub

Colorado BLM 1997
Test Pilot Worksheet

PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _ _

Page 7

POINT NUMBER ☐ SITE 1 or 2 (CIRCLE)

PARENT MATERIAL AND GEOLOGY

Parent Material (Check one for each line)

1. Kind: ☐ 01 Alluvium, ☐ 02 Colluvium, ☐ 03 Eolian, ☐ 04 Mixed, ☐ 05 Residuum, ☐ 06 Glacial, ☐ 07 Organic
2. Texture: ☐ 01 Sandy, ☐ 02 Loamy, ☐ 03 Clayey
3. Reaction: ☐ 01 Acidic, ☐ 02 Alkaline, ☐ 03 Calcareous, ☐ 04 Noncalcareous, ☐ 05 Saline

Bedrock:

1. Type (Select one):

   Sedimentary: ☐ 01 Sandstone, ☐ 02 Shale, ☐ 03 Limestone, ☐ 04 Conglomerate, ☐ 05 Other _____

   Igneous: ☐ 06 Granite, ☐ 07 Basalt, ☐ 08 Rhyolite, ☐ 09 Other _____

   Metamorphic: ☐ 10
2. Reaction (Select one): ☐ 01 Acidic, ☐ 02 Alkaline, ☐ 03 Calcareous, ☐ 04 Noncalcareous, ☐ 05 Saline

SOIL IDENTIFICATION AND VERIFICATION

Brief Profile Description to 60 inches (40 inches is sufficient)

Depth	Horizon	Modifier Texture		Color			Effervesc	*EC	*pH
				Hue	Value	Chroma			
0 to									
to									
to									
to									
to									
to									

* Populate with data only if significant

Root Barrier depth to top: _____

Type (Select one): ☐ 01 None, ☐ 02 Paralithic Contact, ☐ 03 Lithic Contact,
☐ 04 Petrocalcic, ☐ 05 Duripan, ☐ 06 Compacted

Rock Fragments (Surface) Percent_____ Class_____

Rock Fragments (Control Section) Percent_____ Class_____

Shape-Round Classes		Shape-Flat Classes	
GRF - Fine Gravel	0.2 - 0.5 cm diameter	CN - Channer	0.2 - 15 cm long
GRM - Medium Gravel	0.5 - 2.0 cm diameter	FL - Flagstone	15.0 - 38 cm long
GRC - Coarse Gravel	2.0 - 7.6 cm diameter	STF - Stone	38.0 - 60 cm long
CB - Cobble	7.6 - 25.0 cm diameter	BYF - Boulder	> 60 cm long
ST - Stone	25 - 60.0 cm diameter		
BY - Boulder	> 60 cm diameter		

Notes: _____

PSU NUMBER_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

POINT NUMBER ☐ SITE 1 or 2 (CIRCLE)

SOILS INFORMATION

NEAR SURFACE MORPHOLOGY to 30 cm (For Soil Quality)

Depth	Horizon	%Clay	Water State	Structure			Moisture Rupture Resistance	*EC	*pH
				Grade	Size	Shape			
0 to									
to									
to									
to									
to									
to									

*Optional Data

----------Structure----------

Water State		Grade	Size	(if platty)	Shape	Moist Rupture Resistance
D	Dry	1 Weak	vf - very fine	(very thin)	gr - granular	L - Loose
SM	Slightly Moist	2 Moderate	f - fine	(thin)	sbk - sub-angular blocky	VFr - Very Friable
MM	Mod. Moist	3 Strong	m - medium	(medium)	abk - angular blocky	Fr - Friable
VM	Very Moist		c - coarse	(thick)	pl - platy	Fi - Firm
W	Wet		vc - very coarse	(very thick)	pr - prismatic	Vfi - Very Firm
					cpr - columnar	EFi - Extremely Firm
					m - massive	
					sg - single grained	

Zone of Maximum Bulk Density in top 30 cm:_____to_____cm

CRUST DESCRIPTION

Type (check all that apply): ☐ 01 Lichen, ☐ 02 Moss, ☐ 03 Mineral/other, ☐ 04 None

Complete the following section for mineral crust only...

Dry color:_____ Thickness (mm):_____

Dry Rupture Resistance (Select one): ☐ 01 Weak, ☐ 02 Moderate, ☐ 03 Strong, ☐ 04 Extremely Strong, ☐ 05 Too Wet,

Crust particle size class (check one): ☐ 01 Sandy, ☐ 02 Loamy, ☐ 03 Clayey

SOIL SAMPLES COLLECTED

Identify which soil samples were collected at the PSU-sample point

☐ 01 Primary Soil Sample - Soil Pit (0-5cm),

☐ 02 Soil quality transect samples (0-2.5 and 2.5-10 cm)
Composite by Cover Strata (Grass/Shrub/Tree/Bare)

NOTES: _____

The component name is the soil reference name (inclusions are identified as a component). The soil series name is usually used, but the component is sometimes a miscellaneous land type or soil family. Up to 60 characters are available for this entry. The entry provides the final linkage of the NRI point to soils information data base. Be sure to indicate whether the soil is a named component of the soil mapping unit, and named inclusion or and unnamed inclusion.

Ecological Site Number and Name. Identify the Ecological Site Number and Name based on the soil and setting of the sample point. The Ecological Site Number should include the Major Land Resource Area Number, Region number, site number, state and the precipitation zone an example is 49BY228CO for Mountain loam 15 to 20. Be sure to indicate whether the existing site matches the ecological site description, marginally matches, or doesn't match it at all. Be sure to indicate whether the ecological site description clearly depicts what is currently on the site (fits the site description), marginally fits the description, or doesn't fit it at all.

NOTE: Most BLM lands have highly variable landscapes with order 3 soil surveys with map units that are predominantly complexes, associations of 2 to 3 soil series, and undifferentiated units (See illustration 8 for kinds of soil mapping units.) There will be instances where the PSU sample points may not be on soil components named in the soil map unit name, but occurs on inclusions named in the map unit description or on named similar soil (soils with similar plant growth properties). In these instances, inclusions and named similar soils will be identified as the soil component.

During the soil identification and verification process, be sure to review and evaluate the range of characteristics allowed for the soil map unit component soils. Where PSU points occur on unmapped areas, it is the intent to map the PSU or identify the soils at the point with the map unit used in the soil survey area with accompaniment of assistance from the local soil survey staff within the soil survey area.

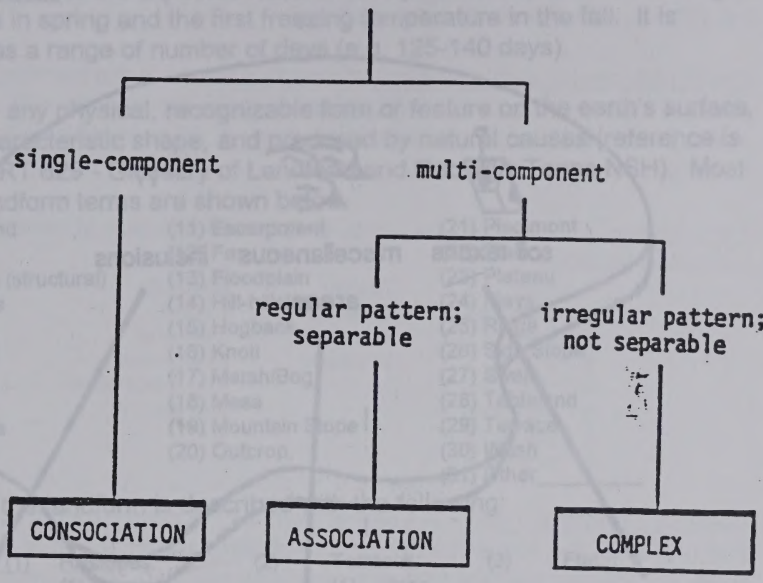
SETTING AND SITE CHARACTERISTICS

Elevation is the vertical distance from mean sea level to a point on the earth's surface. Enter the elevation in feet from the GPS instrument. Another option is to enter the range of elevation in feet obtained from a USGS quadrangle sheet (e.g. 5280 or 5280-5300).

Precipitation, Mean Annual. Precipitation refers to all forms of water that fall from the atmosphere and reach the ground is expressed as a range in total annual precipitation in inches (e.g. 10-13). This is the precipitation zone associated with the ecological site description.

Illustration 8

KINDS OF SOIL MAPPING UNITS



A soil consociation is a mapping unit in which only one soil taxon or miscellaneous area is identified (+ allowable inclusions).

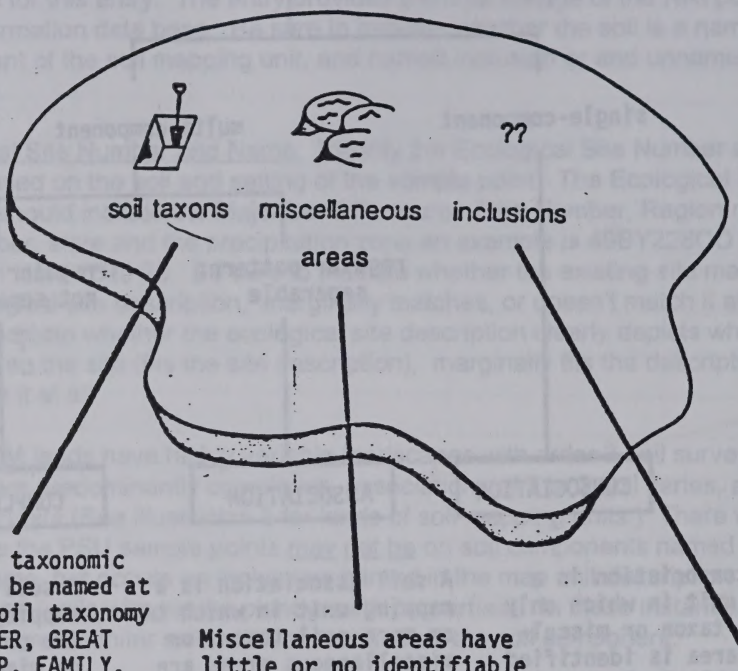
A soil association is a mapping unit in which two or more soil taxons or miscellaneous areas are identified (+ allowable inclusions). The named components lie in a regular geographic pattern and can be located in the field by visible landscape features. Technically, the named components are individually large enough to be delineated at a scale of about 1:20,000. Components are not separately delineated because the use of the survey does not require this level of detail.

In naming associations, components are separated by a hyphen and the term "association" is always used.

A soil complex is a mapping unit in which two or more soil taxons or miscellaneous areas are identified (+ allowable inclusions). The named components, however, lie in a very intricate pattern and cannot be located in the field by visible landscape features. Technically, the named components are either not large enough or have such a complicated pattern that they are not separable at a scale of about 1:20,000.

In naming soil complexes, components are separated by a hyphen; the term "complex" may or may not be used depending on the phase modifier.

COMPONENTS OF SOIL MAPPING UNITS



Soil taxonomic components can be named at any level of soil taxonomy (ORDER, SUBORDER, GREAT GROUP, SUBGROUP, FAMILY, or SERIES); the level of taxonomic classification depends on the use of the survey data and need NOT be uniform across the survey area. Thus, soils may be classified at the suborder or family level in some areas, while at the series level in others.

Miscellaneous areas have little or no identifiable soil OR have some highly unfavorable attribute which would override most use and management options.

EXAMPLES: Badland
Rock Outcrop
Riverwash
Playas

Inclusions are minor areas of soil or non-soil materials which fall outside the accepted range of the named components; they arise due to mapping scale limitations and/or to errors in boundary delineation. Inclusions will generally comprise no more than about 15% of a mapping unit.

Frost-free Period is the expected number of days between the last freezing temperature in spring and the first freezing temperature in the fall. It is expressed as a range of number of days (e.g. 125-140 days).

Landform is any physical, recognizable form or feature on the earth's surface, having a characteristic shape, and produced by natural causes (reference is made to PART 629 - Glossary of Landform and Geologic Terms NSH). Most common landform terms are shown below.

(1) Badland	(11) Escarpment	(21) Piedimont
(2) Basin	(12) Fan	(22) Plain
(3) Bench (structural)	(13) Floodplain	(23) Plateau
(4) Breaks	(14) Hill-hillslope	(24) Playa
(5) Bluffs	(15) Hogback	(25) Ridge
(6) Butte	(16) Knoll	(26) Side Slope
(7) Cliff,	(17) Marsh/Bog	(27) Swale,
(8) Cove	(18) Mesa	(28) Tableland
(9) Cuesta	(19) Mountain Slope	(29) Terrace
(10) Dune	(20) Outcrop,	(30) Wash
		(31) Other_____

Position on the landform is described with the following:

(1) Hillslopes:	(2) Terraces:	(3) Flat:
(1) summit	(1) riser	
(2) shoulder	(2) tread	
(3) backslope		
(4) footslope		
(5) toeslope		

Slope Shape is described both vertically down the slope and horizontally across the slope. **Vertical slope shape** terms are: concave, convex, and linear. **Horizontal slope shape** terms are: concave, convex, and linear.

Slope Gradient is the inclination of the surface of the soil from the horizontal expressed as a percentage (e.g. 10-25).

Slope Aspect is the direction toward which the surface of the soil faces. The direction is expressed as a compass point. Entries are north, northeast, east, southeast, south, southwest, west, northwest.

Microtopographical Position (Microrelief) Descriptions refer to local slight irregularities in form and height of land surface that are superimposed upon a larger landform, including such natural features as:

(1) shrub-coppice dune/intercoppice
(2) terracette (catsteps)
(3) playette
(4) none
(5) Other _____

Identify the microtopographical positions occurring within a 10-meter radius of the PSU sample point. See Illustration 9.

Soil Pit Micotopographic Position. Sample position is the microtopographical position that represents the physical area where the specific soil is identified and primary near-surface properties are evaluated. (See microtopographical description for list of features.

Parent Material. Identify type, kind, texture and reaction of parent material. (Unconsolidated)

Kind	Texture	Reaction
1 alluvium	1 sandy	1 acidic
2 coluvium	2 loamy	2 alkaline
3 eolian	3 clayey	3 calcareous
4 mixed		4 noncalcareous
5 residuum		5 saline
6 glacial		
7 organic		

Geology - Bedrock Type. A general term for the solid rock (lithic and paralithic) that underlies the soil and other unconsolidated material that is exposed at the surface. Identify general type and chemical reaction. Note geologic formation name.

Type	Reaction
Sedimentary	1 acidic
sandstone	2 alkaline
shale	3 calcareous
limestone	4 noncalcareous
conglomerate	5 saline
Igneous	
granite	
basalt	
rhyolite	
Metamorphic	

BRIEF PROFILE DESCRIPTION TO 150 CM.

To identify and confirm the soil component at the point, dig a mini-soil pit and use a soil auger to briefly describe the main diagnostic soil features (use care not to disturb the sampling point).

Illustration 9 Microtopographic Illustration 9

The mini-soil pit should have approximately a 20-inch sampling face, 12 to 18 inches wide and 16-20 inches deep.

The sampling face is best facing the sun with the area behind it protected from any disturbance as it will be used for the soil identification process, the near surface soil properties and collection of the primary soil samples. Fill from the pit will be placed on a small tarp on one side of the pit to facilitate closing and minimize disturbance.

Depth begins with 0 and is entered in inches. Subdivide only those horizons necessary for confirmation of the soil series.

Horizon should correspond with normal horizon nomenclature.

Texture is the USDA texture with modifier. The entry should include the codes for texture modifier followed by the texture class. Terms used in lieu of texture are potential entries. Refer to Appendix B from Exhibit 618-75 of the 1993 version of the National Soil Survey Handbook.

Color is the Munsell notation for **hue, value,** and **chroma**. Use Munsell color charts. Use moist colors only.

Effervescence is the reaction of the soil with treatment to cold dilute (1N) hydrochloric acid. This data field only needs to be populated if it is significant in determining the soil series. Effervescence entries and their descriptions are:

(0)	None	
(1)	Very slightly effervescent	few bubbles seen
(2)	Slightly effervescent	bubbles readily seen
(3)	Strongly effervescent	bubbles form low foam
(4)	Violently effervescent	thick foam forms quickly

EC - Electrical Conductivity is the conductivity of an extract from a saturated soil paste. EC is a measure of the concentration of water-soluble salts in soil. Field measurements will be made with a field conductivity meter and recorded to the nearest mmhos/cm (e.g. 1-2).

pH (Reaction) - Soil reaction is a numerical expression of acidity or alkalinity of a soil. Field measurements will be made with a field pH meter or pH indicators and will be recorded to the nearest one-tenth pH (e.g. 7.4).

Root Barrier - Kind and Depth to Top. A root barrier is a physical restriction to rooting. The depth provides the physical limit for roots

within the upper 150 cm of soil. Record the root barrier kind for the first encountered total barrier to root penetration.

(0)	None	(6)	Lithic contact
(1)	Paralithic contact	(7)	Duripan
(2)	Fragipan	(8)	Petrogypsic
(3)	Petrocalcic	(9)	Petroferric
(4)	Densic contact	(10)	Continuous orstein
(5)	Placic	(11)	Compacted layer

Rock Fragment Cover Percent. Rock fragment cover is a visual estimate of the percentage of the soil surface occupied by rock fragments within a 10 meter radius around the point. Enter as a narrow range of percent (e.g. 10-15). Enter shape and size rock fragments (See Appendix D.)

Shape-Round Classes		Shape-Flat Classes	
GRF - Fine Gravel	0.2 - 0.5 cm diameter	CN - Channer	0.2 - 15 cm long
GRM - Medium Gravel	0.5 - 2.0 cm diameter	FL - Flagstone	15.0 - 38 cm long
GRC - Coarse Gravel	2.0 - 7.6 cm diameter	STF - Stone	38.0 - 60 cm long
CB - Cobble	7.6 - 25.0 cm diameter	BYF - Boulder	> 60 cm long
ST - Stone	25 - 60.0 cm diameter		
BY - Boulder	> 60 cm diameter		

Profile notes: Provide other information that may be important in verifying how well the soil component fits the mapping unit. If the soil component would normally be identified as this soil or as a similar soil, verify that the soil component name is correct. Information such as mottling and soil profile drainage can be included.

SOIL QUALITY EVALUATION - NEAR SURFACE SOIL PROPERTIES are used in soil quality evaluation. Several properties within a 30 cm depth (mini-soil pit) are used. The features considered are:

(1) Soil properties and conditions (%clay, water state)
(2) Soil structure
(3) Resistance of the soil mass to rupture
(4) Evaluation of the least permeable zone
(5) Soil chemistry (pH, EC, OM)
(6) The expression of crust

NEAR SURFACE MORPHOLOGY. Subdivide the 30 cm profile into horizons or zones of properties that might change permeability. Start at the soil surface and measure down.

Depth is entered as the upper and lower depth in centimeters.

Horizon notation should correspond with normal horizon nomenclature in the Soil Survey Manual.

Field percent clay is the percentage of clay in the horizon as determined by field texturing.

Water state is the field moisture state as sampled. The classes are:

(1) D - Dry
(2) SM - Slightly moist
(3) MM - Moderately moist
(4) VM - Very moist
(5) W - Wet

Structure -. Structure evaluation for the near-surface morphology will use grade, size, and shape criteria. It relates to thickness, infiltration, and permeability behavioral characteristics (micro-horizons) of the soil.

Grade of structure is: (ignore if massive or single grain)

(1) Weak
(2) Moderate
(3) Strong

Size of structure is:(ignore if massive or single grain). (If the *shape* is platy (pl), see next section, the size descriptive name is different but the code id is the same (vf, f, m, c, vc).

		(If platy)
vf	Very fine	Very thin
f	Fine	Thin
m	Medium	Medium
c	Coarse	Thick
vc	Very coarse	Very thick

Shape of structure is:

gr - Granular	pr - Prismatic
sbk - Subangular blocky	cpr - Columnar
abk - Angular blocky	m - Massive
pl - Platy	Sg - Single grain

Moisture rupture resistance is the rupture resistance of block-like specimens.

(1) L - Loose
(2) VFr - Very friable
(3) Fr - Friable
(4) Fi - Firm
(5) FVi - Very firm
(6) EFi - Extremely firm

EC - This data field is optional for characterization of soil health. See EC section on page 28

pH (Reaction) -This data field is optional for characterization of soil health. See EC section on page 28

OM - Organic Matter is the weight of decomposed plant and animal residue and is expressed as a weight percentage of the soil material less than 2 mm in diameter (e.g. 0.5-1.5). The organic matter will be determined by a lab test from samples taken from the field (Optional data).

ZONE OF MAXIMUM BULK DENSITY IN UPPER 30 CM. Probe with a knife or other instrument to determine the zone of greatest resistance (bulk density). Use spade soil slice to determine soil structure indicators of compaction. This measurement will be taken at mini-soil pit site.

Upper depth is the distance from the surface of the soil to the upper boundary of this zone.

Lower depth is the distance from the surface of the soil to the lower boundary of this zone.

An optional measurement of bulk density identification may be taken at other microtopographical positions in the proximity of the primary soil sample site. This would be conducted only on selected PSU points with specific sampling instructions.

CRUST DESCRIPTION - Crust expression is described with crust type, color, thickness, dry rupture resistance, and family particle size class.

Crust type is (0) none, (1) biocrust, or a (2) mineral crust. Biocrusts are sometimes described as cryptogam cover and are composed of moss and lichen. These crusts indicate long stability of the site and occur only on pasture, range, or forested sites that have not recently burned. Mineral crusts can occur on any land cover and are important for infiltration of water and emergence of seedlings.

Dry surface color is the hue, value, and chroma of the dry surface of the crust. Surface color is important to determine albedo or reflectance of the surface for erosion modeling. The square of the color value is used as an estimation. Reflectance is important in energy transfer. If the soil surface is wet, record not applicable (N/A).

Thickness of crust is measured. Measurement should be made for the distance from the top of the crust to where the massive conditions disappear. Crust

thickness is important to understand the resistance to rupture. Enter thickness classes:

	mm
(1)	0-2
(2)	2-8
(3)	8-20
(4)	20+

Crust material particle size is the soil taxonomic family classes of (1) sandy, (2) loamy, or (3) clayey. It is used in conjunction with crust thickness and dry rupture resistance to evaluate the significance of the crust for its effect on infiltration of water and emergence of seedlings.

Dry rupture resistance class of platy is a descriptive classification of the resistance of the crust to pressure. The specimen should be 10 to 15 mm on edge and 5 mm thick or the thickness of occurrence if less than 5 m. Surface crust thickness is inclusive of the crust proper and the adhering soil material beneath. The specimen is grasped on edge between extended thumb and first finger. Force is applied along the longer of the two principal dimensions. Force exerted is calibrated with the set of springs provided and placed into the following classes.

Classes	Force in Newtons
(1) Weak	Removable, <1 to 3
(2) Moderate	3 to 20
(3) Strong	20 to 80
(4) Extremely strong	≥80
(5) Too wet to determine	

AGGREGATE STABILITY. Aggregate breakdown relates closely to infiltration and erodibility. If soil aggregates are unstable during a rainfall event, decreased water infiltration results, due to partial blocking of pores with aggregate particles.

Measurement of aggregate stability and strength (soil aggregates and crusts) will be determined by a slake test.

Soil stability will be determined on soils from three strata: bare soil, grass, and shrub and correlated to microtopographical positions. Soils will be sampled at random along vegetation transects.

Soil will be tested from both the upper surface (0-1/4") layer and from just below the surface (3/4-1").

These two measurements respectively will provide an indication of (1) current stability and (2) potential future stability following crust disturbance. The slake test should be done only on air-dry soils as moist soil will tend to overestimate relative stability. Soil stability should be measured on soil fragments, 6-8 mm in diameter and 2-3 mm thick

Soil stability is rated according to the time required for the fragment to disintegrate during the 5-minute immersion (classes 1-3) or the proportion of the soil fragment remaining on the mesh after the three extraction-immersion cycles (classes 4-6).

Criteria for assignment of soil slake class are based on (1) the time taken for 50% or more of the soil segment to disintegrate when inserted into deionized water (classes 1-3) or (2) if no disintegration has occurred by 300 seconds (5 minutes)the % soil remaining on the sieve following three slow extraction-reinsertion cycles (classes 4-6). Soil which is too unstable to permit sampling is assigned slake class 1.

Slake Class (Stability Class)	Criteria for Assignment to Slake Class
1	50% of soil structure lost within 5 seconds of insertion in water.
2	50% of soil structure lost between 5-30 seconds after insertion.
3	50% of soil structure lost between 30-300 seconds after insertion.
4	0-25% of soil remaining on sieve after 3 dipping cycles.
5	>25-75% of soil remaining on sieve after 3 dipping cycles.
6	>75-100% of soil remaining on sieve after 3 dipping cycles.

Slake Test Field Sampling Procedures. Use Soil Quality Test + Sampling form (Illustration 10) To recorded information on aggregate stability.

1. Identify, and rank the vegetation strata. All areas of plot must fit into one strata. Strata must be ranked. Points with overlapping strata assigned strata with highest rank. Standard; g-grass/s-shrub/t-tree/b-bare

2. Place pin flags, 3 feet from the vegetation transect line on the opposite side of the production plots at distances noted on table 1 (0, 20, 40, 60, etc.) Record

the Vegetation Strata and Microtopographic Unit at each of the 16 points. Avoid trampling points. .

Vegetation strata
- S - Shrub
- G - Grass
- B - Bare
- O - Other_____

Microtopo Units
1. Coppice
2. Coppice bench
3. Intercoppice
4. Terracette Playette
5. Other_____
6. None

Table 1

Transect	Distance	Vegetation Strata	Microtopo Unit	0 - 5 mm			20 - 25 mm		
				Start	Sieve	Class	Start	Sieve	Class
1 (N-S)	0			0:00	5:00		2:00	7:00	
1	20			0:15	5:15		2:15	7:15	
1	40			0:30	5:30		2:30	7:30	
1	60			0:45	5:45		2:45	7:45	
1	90			1:00	6:00		3:00	8:00	
1	110			1:15	6:15		3:15	8:15	
1	130			1:30	6:30		3:30	8:30	
1	150			1:45	6:45		3:45	8:45	
2 (W-E)	0			0:00	0:50		2:00	7:00	
2	20			0:15	5:15		2:15	7:15	
2	40			0:30	5:30		2:30	7:30	
2	60			0:45	5:45		2:45	7:45	
2	90			1:00	6:00		3:00	8:00	
2	110			1:15	6:15		3:15	8:15	
2	130			1:30	6:30		3:30	8:30	
2	150			1:45	6:45		3:45	8:45	

3. Return to each pin flag and collect a small aggregate sample from the surface (0-5 mm) and sub-surface (20-25 mm) for soil stability test. Place in the dry baskets in appropriate cells in the slack test sample box. Always use the first sample collected. Do not collect surface (0-5 mm) samples when the pin flags fall on rock, litter or moss. When this occurs record the appropriate code in place of the stability class:

R= Rock (0-5 and 20-25 mm). For bed rock

L=Litter (0-5 mm) for strongly developed O horizon (litter is stable with respect to wind and water)
M=Moss (0-5 mm).

For both Litter and Moss, the 20-25 mm samples should be collected at depths below soil surface.

4. If soil samples are wet, leave boxes open and allow to air-dry for as long as possible. Remove the baskets from slack test sample box. Run stability tests by filling each slot in the slack test sample box with deionized water and then emersing each baskets into its designated slot in the sequence listed on table 1. After 5 minutes, remove each basket (sieve) from the solution and record the stability class on the form.

5. Return to each pin flag and collect two additional soil sample one at depths of 0-2.5 and second at depths of 2.5-10 cm. To collect these samples drive the 3 inch ring into the soil to a depth of 2.5 cm, and put the soil inside the ring into a plastic ziplock bag. Repeat this procedure with the 2 inch sampling tub to a depth of 10 cm. Soil samples from each point should be combined with other soil samples from the same vegetation strata. Send air-dry soil samples to Al Amen RS140, National applied Resources Sciences Center, building 50, Denver Federal Center, P.O. Box 25047, Denver , Colorado, 80225-0047. Be sure to include the following information on the bags; PSU, and point number, vegetation strata, and soil depth (0-2.5, or 2.5-10).

SOIL SAMPLING - Sampling for reference purposes, Field Test Analysis and/or Possible Future laboratory analysis (for selected sites or all sites).

Sample Depths - Procedures to be used.

- Soils with a "O" horizon - sample the "O" horizon and the upper 10 cm of the mineral soil.

- All other points are sampled at depths surface layer (1 to 7 cm).

Sample Collection

For the 0-5 cm samples, (surface): Primary sample (equivalent to sample volume/quart):

- Lay the wood board flat on the soil surface and cut along its edges.

- Remove a soil sample of the board thickness (the sample should be equivalent to the volume of the board). Bag and label.

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POINT NUMBER ☐ **SITE 1 or 2 (CIRCLE)**

SOILS INFORMATION

SOILS TRANSECT SOIL QUALITY TEST + SAMPLING
Distance from transect line_____(ft)

Transect	Distance	Cover Strata	Microtopo Unit	0 - 5 mm			20 - 25 mm		
				Start	Sieve	Class	Start	Sieve	Class
1 (N-S)	0			0:00	5:00		2:00	7:00	
1	20			0:15	5:15		2:15	7:15	
1	40			0:30	5:30		2:30	7:30	
1	60			0:45	5:45		2:45	7:45	
1	90			1:00	6:00		3:00	8:00	
1	110			1:15	6:15		3:15	8:15	
1	130			1:30	6:30		3:30	8:30	
1	150			1:45	6:45		3:45	8:45	
2 (W-E)	0			0:00	0:50		2:00	7:00	
2	20			0:15	5:15		2:15	7:15	
2	40			0:30	5:30		2:30	7:30	
2	60			0:45	5:45		2:45	7:45	
2	90			1:00	6:00		3:00	8:00	
2	110			1:15	6:15		3:15	8:15	
2	130			1:30	6:30		3:30	8:30	
2	150			1:45	6:45		3:45	8:45	

Cover * Strata (Ranked by preference)

(1)_____

(2)_____

(3)_____

(4)_____

*all area of plot must fit into one strata. Strata must be ranked. Points with overlapping strata assigned strata with highest rank. Standard;grass/shrub/tree/bare

Microtopo Units
1. Coppice
2. Coppice bench
3. Intercoppice
4. Terracette Playette
5. Other_____

Class	Criteria for assignment to stability class
0	Soil to unstable to sample (fall through sieve)
1	50% of structual integrity lost within 5 seconds of insertion
2	50% of structual integrity lost within 5- 30 seconds after insertion
3	50% of structual integrity lost within 30- 300 seconds after insertion
4	0-25% of soil remaining on sieve after 5 dipping cycles
5	>25-75% of soil remaining on sieve after 5 dipping cycles
6	>75-110% of soil remaining on sieve after 5 dipping cycles

For microtopographical position soil samples:

Soil samples representing specific microtopographical positions will be taken at depths of 0-5 cm with a core sampler. Volumes of samples for each topographical position would be 1 pmt (480 ml), and placed in plastic heavy-duty freezer bags (1 quart capacity) and labeled.

For special soil samples:

Special soil samples for specific selected sites may be taken for testing protocols. Specific instructions and sites will be identified.

- 5-15 cm depth soil sample
- zone of highest bulk density within 30 cm profile

Bagging and Labeling Soil Samples:

- Place soil samples in plastic heavy-duty freezer bags (1 gallon capacity). Avoid unnecessary crushing of samples.
- Label on the ID block on the plastic bag with black permanent marker pen the following information:

  FIPS CODE _____; PSU ID _____; Sample Point No. _____; Depth: _____ to _____ centimeters; Date: _____; Initials: _____.

RANGELAND

TRANSECT LAYOUT

Align a 150 ft tape on a North-South bearing with the 75 foot mark at the Sample Point. This will become transect 1. The beginning of transect 1 will be at the north end of the tape. For Transect 2 align a second 150 ft tape on an East-West bearing with the 75 foot mark at the Sample Point. The beginning of transect 2 will be at the west end of the tape. See Figure 1.

Five weight estimate plots will be located along each transect with the edge of each plot adjacent to the tape. Plots on transect one will be on the west side of the tape and plots on transect 2 will be on the south side of the tape. Plots 1- 5 will be (Transect 1) at the 12.5 ft, 37.5 ft, 62.5 ft, 112.5 ft, and 137.5 ft marks on the tape. Plots 6- 10 will be located on Transect 2 at the 12.5 ft, 37.5 ft, 87.5 ft, 112.5 ft, and 137.5 ft marks on the tape. All foot traffic along the transect should

NRI PLOT

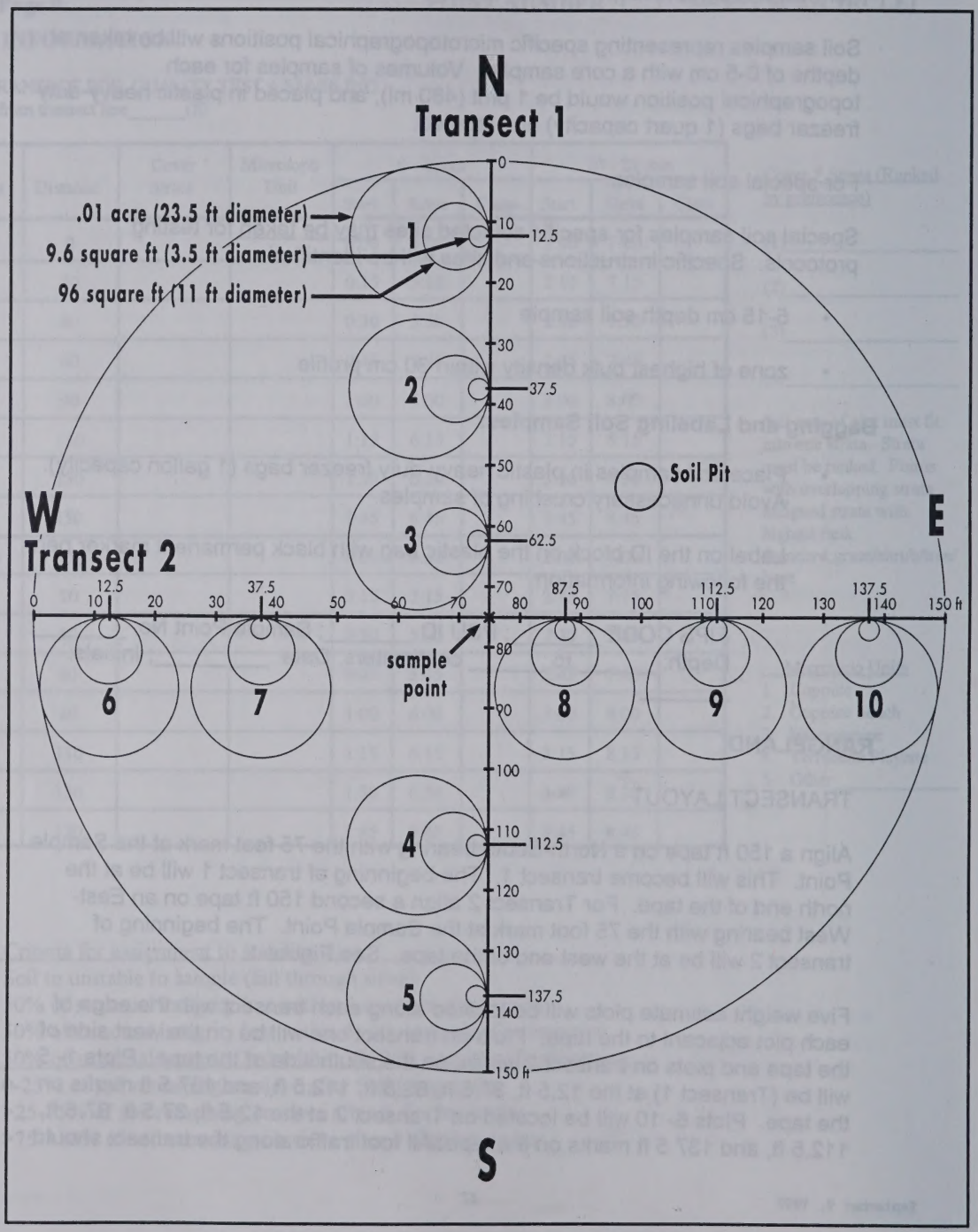


figure 1

be done on the east side of the north south transect and on the north side of the east-west transect.

If either of the two tapes extend into a different ecological site, production data, cover data, soils data, and rangeland health data will be recorded separately for the two ecological sites. In this situation, identify the data for each site as Point 1 and Point 1a, or Point 2 and Point 2a depending on which point the two sites occurred on the particular Primary Sampling Unit (PSU). Additional production plots will be added to the opposite end of the transect of the Primary Site (largest of the two), so that there will be a total of 10 production plots in this ecological site. If addition plots cannot be added to the opposite end of the transect the additional plots will be added to the end of the other transect See Figure 2.

Plot size. **Determine plot size for each species, based on the discussion below, before the weight estimate procedures are started**. All weight estimate plots will be placed with the edge of each plot adjacent to the tape at the predetermined marks.

Herbaceous Species: Production of herbaceous species (grasses and forbs) will be determined using the 9.6 ft^2 plots. The weight unit procedure should use grams as the unit of measure.

Shrubs and/or Half Shrubs to 16 feet Tall: Production for this group of species will be determined using the 96 ft^2 plots. The expanded plot can be laid out by using a rope or cord 5 ½ ft long. One examiner holds one end of the rope at the edge of the tape at the designated location, and the second examiner extends the cord perpendicular to the taped. This will become the center of the 96 ft^2 plot. The first examiner then scribes a circle around the center of the plot. The weight unit procedure should use pounds or grams as the unit of measure.

NOTE: 96 ft^2 plots *will only be used* when no trees or shrubs over 16 feet occur within the 150 ft. Diameter Plot. If trees of any size, or shrubs 16 ft. tall or taller occur within the 150 ft diameter plot design, the .01 acre plots will be used in lieu of the 96 ft^2 plot to determine production of Pinyon and Juniper, all shrubs and half shrubs regardless of size, and, characterization of all tree species.

Tree Species of any Size, and/or Shrubs over 16 ft Tall. Production on trees, and shrubs that are over 16 feet tall will be determined using .01 acre plots. This plot can be laid out by using a cord 11 ft 10 in long. One examiner holds one end of the rope at the edge of the tape at the designated location and the second examiner extends the cord

NRI PLOT

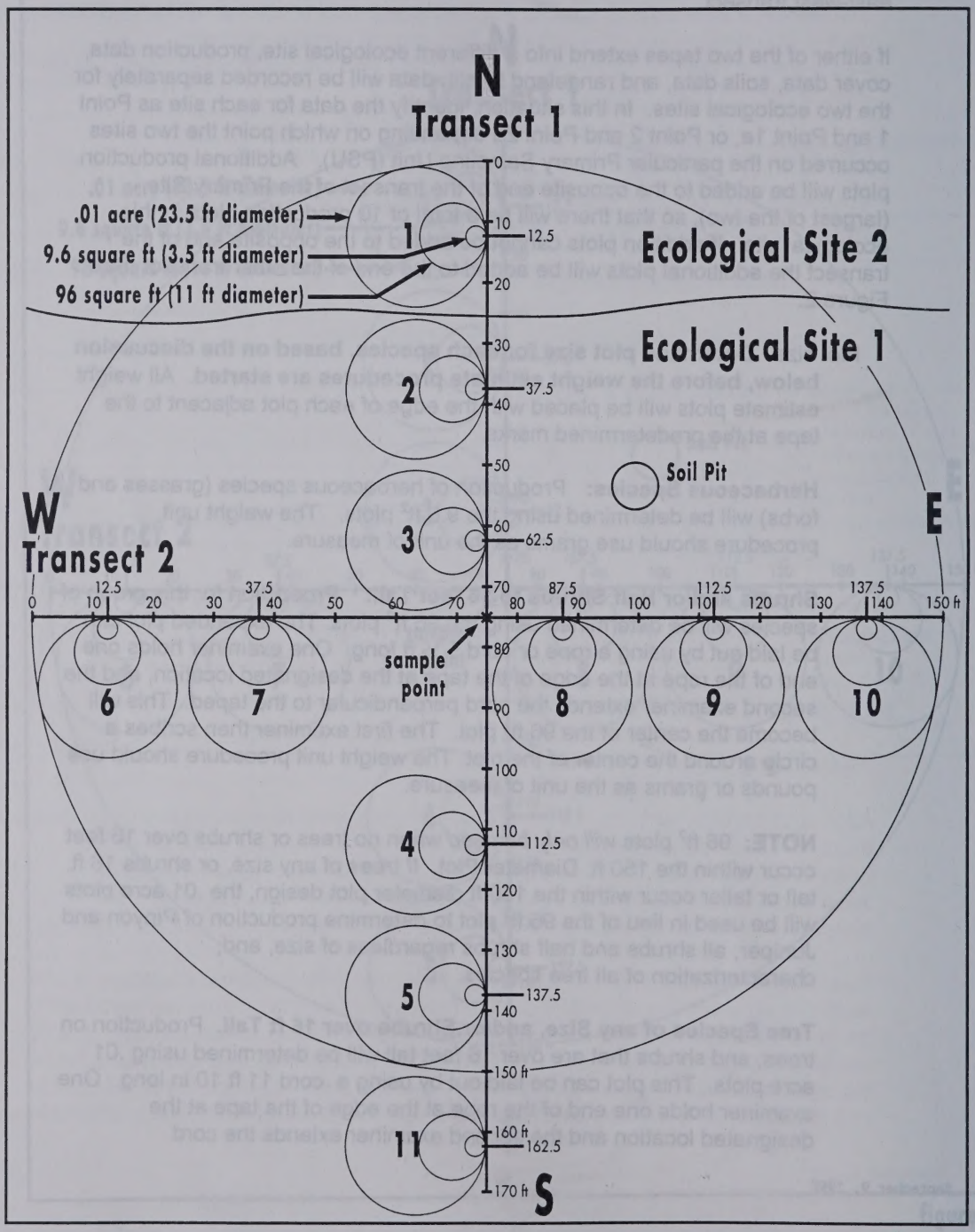


figure 2

perpendicular to the tape. This will become the center of the .01 acre plot. The first examiner then scribes a circle around the center of the plot. The weight unit procedure should use pounds as the unit of measure for trees and either pounds or grams as the unit of measure for shrubs.

NOTE: This plot size *will only be used* if tree species of any size, or shrubs 16 feet tall or taller occur within the 150 ft diameter plot. When this condition exists and the .01 acre plots are used, production will be determined on Pinyon and Juniper, all shrubs and half shrubs regardless of size, and, characterization of all tree species. ***In summary, <u>either</u> the 96 ft^2 plots or the .01 acre plots will be used in conjunction with the 9.6 ft^2 plots for herbaceous species, <u>but not both</u>.***

SPECIES IDENTIFICATION. It is extremely important to identify the correct plant species for the production data, canopy cover by dominant woody species, dominant vegetation height, and tree data. Errors in species identification can dramatically effect the analysis of the study data. Always use easily legible lettering and the standard species codes Natural Resource Conservation Service's (NRCS) PLANTS database, e.g. "Boer4" is *Bouteloua eriopoda.* Unknown species will be coded according to their life form and later identified and entered into the data sheet. Unknown species lifeform codes are:

AAFF*x*= Annual forb	AAGG*x*= Annual grass	SSSS*x*= Shrub
PPFF*x*= Perennial forb	PPGG*x*= Perennial grass	TTTT*x*= Tree

When completing data forms in the field a number can be inserted where the " *x" is* to keep separate more than one unknown in the same category. Samples of these species should be collected and identified as quickly as possible. Be sure to change the codes on the field data forms when these species are identified.

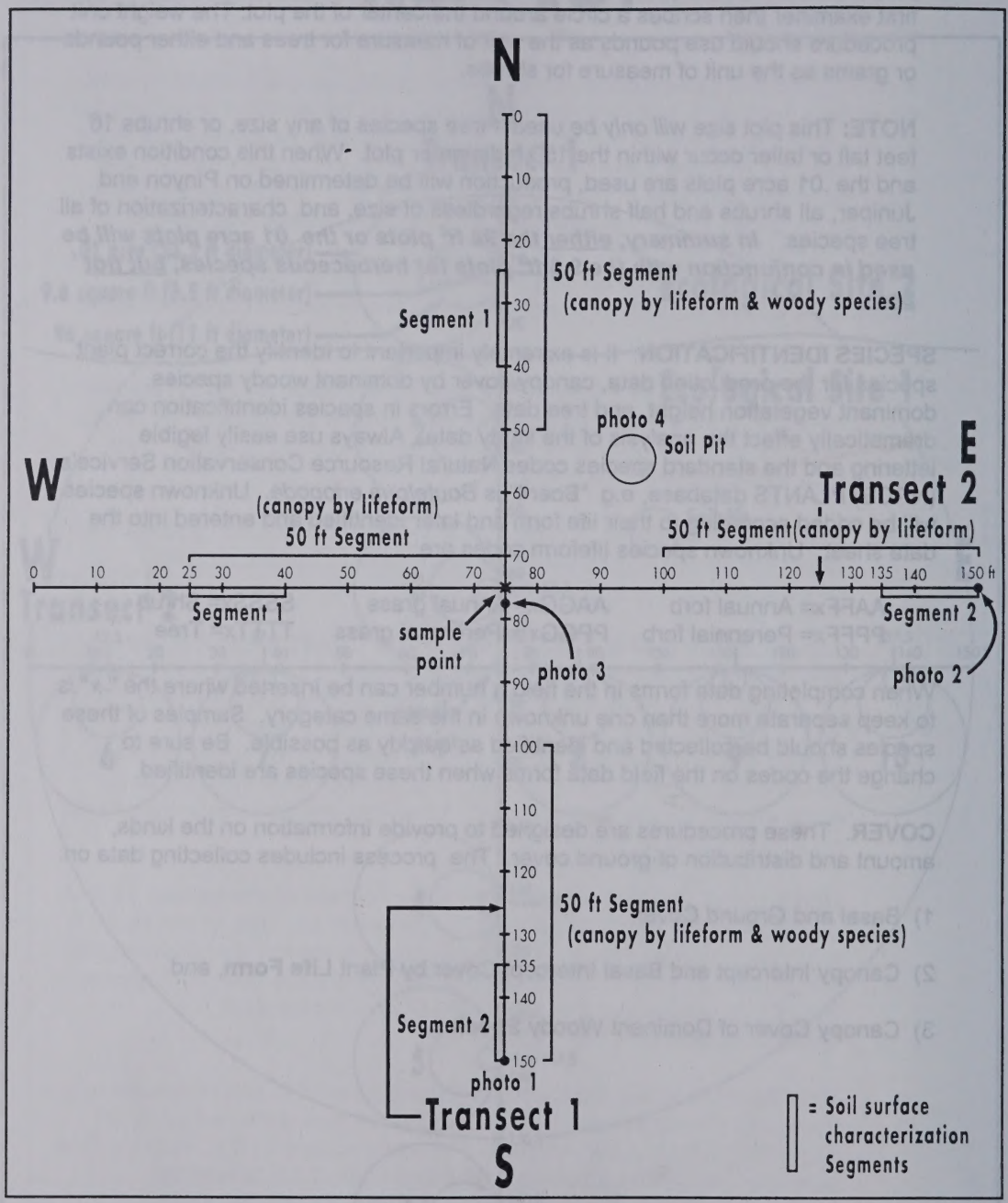
COVER. These procedures are designed to provide information on the kinds, amount and distribution of ground cover. The process includes collecting data on:

1) Basal and Ground Cover,

2) Canopy Intercept and Basal Intercept Cover by Plant **Life Form**, and

3) Canopy Cover of Dominant Woody **Species**.

NRI PLOT—Cover



Transect layout for Basal/Canopy cover measurements and soil surface characterization segments Woody canopy cover.

figure 3

Materials

1) Two 150 foot tapes, marked at 0.1 ft graduations.
2) 3-6 survey stakes to temporarily secure tapes on site.
3) Yardstick graduated in 0.1 ft graduations.
4) Site description forms and data sheets, clipboard and pencil to record measurements.
5) 20 ft expandable pole graduated in 0.1 ft increments

Laying and Reading the Tape. In areas with shrubs, the tape should pass below the shrub canopies in order to keep the tape close to the ground. Secure the origin, center point and the 150 ft end of each tape with surveyor stakes in order to maintain tautness on the tape. This will assist in reading the tape in windy conditions when an unsecured tape will tend to blow or move in the wind.

If needed use additional surveyors stakes at intervals to secure the tape close to the ground and to reduce movement due to wind. Always maintain the same orientation and procedures for the laying out the tapes. Do not walk on the side of the tapes that will be read.

When walking along the transect always walk on the right side of the transect line reading cover intercepts on the left edge of the tape. Read the measurements on the left edge of the transect tape when standing directly above the tape on the right side of it. Do not estimate values from a distance as this can lead to errors due to parallax. Be careful not to disturb vegetation in the production plots.

A yard stick positioned vertically at the leading edge of a plant canopy will improve the accuracy of the measurements, especially where the transect line is not at the same level as the vegetation. Use a longer pole to project canopies from trees under 25 ft in height down to the tape. Tree canopies over 25 feet in height are not recorded since their value in reducing splash erosion is limited.

Sampling Procedures. Cover sampling is a three step process.

1. **Soil Surface Characterization**. Basal cover of perennial plants (by life form) and ground cover (bare, litter, microbiotic crust, and rock/gravel), are recorded on four, 15 ft Soil Surface Characterization transects (Figure 3). Starting/ending points for each 15 foot section of the soil surface characterization segments are **25/40 ft** and **135/150** ft point on each of the two 150 foot transects.

If total basal plant intercepts are 20 or more (number of basal intercept "hits" on plants not length of plant intercepts) **cumulatively on all four 15 ft segment**, no additional basal cover determinations are required on the remainder of the 4, 50 ft canopy segments. If there are less than 20 total basal intercepts encountered on all 4 of the 15 ft segments, then basal intercepts are recorded on the entire length of the four, 50 ft segments. The basal cover of a plant must fill more than 50% of the 0.1 ft unit to be recorded as a basal cover intercept.

The objective of these measurements is to characterize the kind of cover or bare ground at the the soil surface. In areas with a high density of annual grasses or forbs record a basal intercept (designated by the "ANNL" code) if the plant material exceed 50% of the 0.1 ft sampling unit.

Annual grasses and forbs that grew during the current growing season and are now dead should still be counted as a "live" basal hit if the above criteria are met. If the annual plants are over a year old and are still standing they should be recorded as litter and a note made as to the percentage of standing versus decumbent litter.

Ground cover information is recorded on illustration 11 in the "Ground Level" columns under the following headings:

BASAL FROM-TO. Codes used to record basal intercepts are "Grass", "Forb", "Shrub", "Tree", "Succ" (succulents such as cactus) and "Annl" (annual grasses and/or forbs). Basal intercepts are recorded in the first three columns(see table 2) by entering the life form in the CODE column and the measurement on the tape were it starts in the FROM column and the measurement where the lifeform ends in the TO column. If a plant basal hit is dead, the life form code is circled.

GROUND LEVEL. Information on ground level cover is entered in the appropriate column with the headings of:

Bare **Bare ground**. Any soil not covered by litter, microbiotic crust, rock/gravel, or plant basal cover. Record bare soil even if the ground surface has a canopy overstory.

Litr **Litter**. Includes both persistent and non persistent plant materials or other organic material e.g. "cow pies" on the ground surface .

Illustration 11

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COVER - 15 FEET SEGMENTS

Transect _____

Segment 1

Code	BASAL		GROUND LEVEL				Code	BASAL		GROUND LEVEL			
	From	To	Bare	Litter	M.C.	Rock		From	To	Bare	Litter	M.C.	Rock

Segment 2

Code	BASAL		GROUND LEVEL				Code	BASAL		GROUND LEVEL			
	From	To	Bare	Litter	M.C.	Rock		From	To	Bare	Litter	M.C.	Rock

HEIGHT

CODE	AVERAGE HEIGTH	TALLEST	SHORTEST		CODE	AVERAGE HEIGHT	TALLEST	SHORTEST

M.C. **Microbiotic Crust**. Includes all moss, lichen, cyanobacteria, algae that are visible to the recorder.

Rock **Rock/gravel**. Includes all rock/gravel that is at least 2 mm in diameter and that fills > 50% of the 0.1 ft sampling unit.

These components are recorded by entering the beginning tape intercept value in the appropriate "Ground Level" column. The start of the next ground level component is recorded when the previous ground cover component intercept with the tape ends. Therefore the beginning reading of the next cover component also serves as the ending measurement of the previous cover component. The following example shows how transect data is entered into this format.

Table 2
15 Foot Segment Example

	Basal		Ground Level					Basal		Ground Level			
Code	From	To	Bare	Litr	M.C.	Rock	Code	From	To	Bare	Litr	M.C..	Rock
Grass	1.3	1.5	0.0	0.7	1.9	1.2							
Forb	3.9	4.1	1.1	3.1	4.4	3.9							
Succ	5.8	6.4	2.5			4.9							
			5.8										
			7.3										

The component (bare, litr, m.c. rock or vegetation basal hit) that fills the majority (50% or more) of **each** 0.1 ft increment will be recorded. **All 0.1 ft increments along the 15 ft segment must have an entry for proper completion of the soil surface characterization transects**.

2. **Canopy Intercept**. The second step involves recording **canopy** intercept by life form on the four, 50 ft segments. Basal cover is **not** recorded if a total of 20 basal hits are recorded on the four 15 ft segments measured in step one. Only the highest canopy under 25 feet is recorded on the form. Additional canopy layers under the upper canopy are not recorded. Canopy openings less than 0.3 ft are included as part of the canopy.

   Canopy intercepts by life forms are recorded on all four, 50 foot segments on the "50 Foot Line Transect Form" (Illustration 12). These recordings are made between the tape intervals of 0-50 ft (Segments 1) and 100-150 ft (Segment 2) on Transect **1** (North/South tape) and between 25-75 ft (Segment 1) and 100-150 ft (Segment 2) on Transect **2** (East/West tape).

If the four, 15 ft soil surface characterization transects do not contain a total of 20 basal intercepts, then basal intercepts by life forms are also recorded on all four 50 ft canopy intercept segments.

Basal intercepts, if required, are recorded in the first three columns on the left side of the "50 Foot Line Transects" Form (12) using the procedure described in step one. Canopy intercepts are recorded by the categories of "Grass", "Forb", "Shrub", "Tree", and "Succ" (succulents such as cactus). **Annual plant overstory is not recorded.** The "Open" category is used to record a break in life form canopy.

The following example shows how transect data is entered into this form:

Table 3
50 Foot Line Transect (Example)

			Open	Canopy					Open	Canopy (Continued)				
Code	From	To		Grass	Forb	Shrub	Tree	Succ		Grass	Forb	Shrub	Tree	Succ
Grass	1.3	1.5	0.0	1.3	21.1	2.8	4.5							
Shrub	24.1	24.5	1.9	22.7		23.4								
			20.7											
			21.9											
			25.7											

Only the highest canopy under 25 feet is recorded on the form. Canopy layers above 25 feet are not recorded since their value in reducing raindrop impact is limited. Overlapping e.g. **multiple canopy layers are not recorded, only the upper canopy under 25 ft is recorded on the form**.

Canopy openings less than 0.3 ft are included as part of the canopy. Any life form with a canopy intercept must fill more than 50% of the 0.1 ft unit to be recorded. If there is a distinct boundary between adjacent lifeforms canopies and it is greater than 0.1 ft in length, a break in canopy cover is recorded by using the "OPEN" code.

Dead plant canopies are recorded on the form by circling the tape intersect reading (numerical measurement) at the leading edge of the dead plant canopy. Basal Codes are circled if the plant at the basal intercept is dead. Plants with over 3 ft of canopy cover may be partitioned into "dead" and "live" components (see Figure 2). Plants with less than 3 ft of continuous plant canopy should be assigned a "dead" rating only if over 50% of the plant is dead.

Illustration 12

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COVER - 50 FEET SEGMENTS

Transect _____

Segment 1

Code	BASAL			CANOPY						CANOPY				
	From	To	Open	Grass	Forb	Shrub	Tree	Succ	Open	Grass	Forb	Shrub	Tree	Succ

Segment 2

Code	BASAL			CANOPY						CANOPY				
	From	To	Open	Grass	Forb	Shrub	Tree	Succ	Open	Grass	Forb	Shrub	Tree	Succ

WOODY SPECIES CANOPY INTERCEPT USING NORTH/SOUTH TRANSECT FROM 0-50 FT AND 100-150 FT. ENTER SPECIES CODE ON FIRST ROW LINE

3. **Canopy cover by Dominant Woody Species**. The third step involves measuring canopy intercept cover of dominant woody (shrubs and trees) plant species (based on canopy cover). Canopy cover of up to **four** dominant **live** (not dead) woody species (shrubs and trees) is measured on the two 50 ft segments on the **North/South** transect (Transect 1 from 0-50 ft and 100 to 150 ft) previously used to measure canopy cover by lifeform.

Actual canopy cover intercept is measured and recorded. The spatial relationships of woody species is not required, therefore actual canopy intercept **length** (to the nearest 0.1 ft) is recorded not the beginning and ending points.

Canopy cover is recorded at the bottom of the "50 Foot Line Transects" Form Illustration 12. The species code is entered on the first line and the actual **length** the canopy intercepts the tape is recorded in the blanks below. For example if ARTR4 canopy intercepted the tape at 12.3 ft and its canopy ended at 14.8 ft then 2.5 (14.8 ft minus 12.3 ft =2.5 ft) would be entered in the column to the right of the ARTR4 code. If a pinyon pine canopy was over the ARTR4 canopy **both** canopy intercept lengths would be recorded. Overlapping woody plant canopies **are measured** during this procedure.

The minimum sampling unit is still 0.1 ft for the canopy intercept measurements. Canopy openings **less than 0.3 ft** are included as part of the canopy, while canopy openings **greater than .3 ft** are subtracted from the total canopy intercept length recorded on the form.

A tape measure graduated in 0.1 ft increments should be used to measure woody species intercepts along the tape. Using a tape measure eliminates the need to subtract beginning and ending canopy values to obtain the "length" of the canopy intercept.

An example of a partially completed form is shown on table 4.

Table 4

ARTR4		PIED		JUOS		ARTR4							
2.5	.4	14.4		16.3		.9							
3.6	3.2	18.3		10.2		2.5							
1.2	2.1	20.5		.09									
4.6	2.1												
1.2	2.7												

Don't complete these measurements on either of the two 50 ft segments on Transect 2 (E/W transect).

DOMINANT VEGETATION HEIGHT. The height of vegetation e.g. structure is an important attribute in relation to wildlife habitat, structural diversity, snow entrapment (if applicable) and control of soil erosion. The height of up to **5** dominant species (major species providing the majority of canopy cover) encountered along the 300 feet of transect lines are recorded in the following format. All grass/forb values are recorded to the nearest **0.1** ft. Grasses and forbs that have elevated seedstalks are measured at the top of the majority of the leaves, not to the top of the seedstalks.

Tree height is **measured** and recorded to the nearest **1.0** ft if it is under 25 feet and **estimated** to nearest 1.0 ft if over 25 ft. Unlike the cover measurements it is appropriate to record estimated heights greater than 25 ft.

The range of heights by dominant species is documented by recording the average height of the shortest 10% of the plants "SHORT" and the tallest 10 % of the plants "TALL". The average height (AV. HT.) represents the mean height of all plants of a selected species.

This data recordation form is found at the bottom of the "15 Foot Segment" Form (Illustration 11). An example is shown on Table 5.

Table 5
Dominant Vegetation Height (ft) Form

Species Code	AV. HT.	Tall	Short
PIED	26.0	32.0	6.0
ARTRW5	4.5	5.2	1.2
POSE	.7	.8	0.5
CHNA	6.5	7.5	2.8

CROSSING ECOLOGICAL SITE BOUNDARIES. If an ecological site boundary is crossed on one or more of the transects lines, all cover information (Canopy/Basal, Soil Surface Characterization and Woody Plant Canopy Cover Estimates) are collected on a corresponding length of transect on the opposite end according to NRI Pilot Project sampling protocol. Dominant Vegetation Height information is also collected on the new ecological site.

SPECIES COMPOSITION - PRODUCTION. The Vegetation attribute used to determine species composition will be production. Current years production will be determined using the procedures described in the National Resource Conservation Service's National Range Handbook section 600.

In order to be considered in the plot the plant must be rooted in the plot. All current years production which is rooted inside an imaginary cylinder (defined by the plot), and those portions of the plant rooted inside the cylinder which extend outside the cylinder, will be recorded as occurring in the plot. Conversely, current years production of plant species extending into the cylinder from plants rooted outside the plot will not be recorded.

Production and composition of a plant community are determined by estimating, harvesting, or by a combination of estimating and harvesting (double-sampling). Some plants encountered may be threatened, endangered or otherwise protected species (Special Status Plants). Regulations concerning these species may conflict with harvesting procedures described. The weight of such plants is to be estimated, unless special permission for harvesting can be obtained.

Total Annual Production. The total production of all plant species of a plant community during a single year is designated as "total annual production". Total annual production on rangeland includes the above ground parts of all plants produced during a single growth year, regardless of accessibility to grazing animals. An increase in the stem diameter of trees and shrubs, production from previous years, and underground growth are excluded.

Following are guild lines for determining total annual production for Various Kinds of Plants:

(1) Herbaceous plants. Annual production on herbaceous plants i.e., grasses (except bamboos),grasslike plants, and forbs includes all above-ground growth of leaves, stems, inflorescence, and fruits produced in a single year.

(2) Woody plants. (See Appendix E)

(a) Deciduous trees, shrubs, half-shrubs, and woody vines. Annual production includes leaves, current twigs, inflorescence, vine elongation, and fruits produced in a single year.

(b) Evergreen trees, shrubs, half-shrubs, and woody vines. Annual production includes current year leaves (or needles), current twigs, inflorescence, vine elongation, and fruits produced in a single year.

(c) Yucca, agave, nolina, sotol, and saw-palmetto. Annual production consists of new leaves, the amount of enlargement of old leaves, and fruiting stem and fruit produced in a single year. Until more specific data are available and if current growth is not readily distinguishable, consider current production as 15 percent of the total green-leaf weight plus the weight of current fruiting stems and fruit. Adjust this percentage in years of obviously high or low production.

(3) Cacti.

(a) Pricklypear and other pad-forming cacti. Annual production consists of pads, fruit, and spines produced in a single year plus enlargement of old pads in that year. Until more specific data are available and if current growth is not readily distinguishable, consider current production as 10 percent of the total weight of pads plus current fruit production. Adjust this percentage for years of obviously high or low production.

(b) Barrel-type cactus. Until specific data are available, consider annual production as 5 percent of the total weight of the plant, other than fruit, plus the weight of fruit produced in a single year.

(c) Cholla-type cactus. Until specific data are available and if current growth is not readily distinguishable, consider annual production as 15 percent of the total weight of photosynthetically active tissue plus the weight of fruit produced in a single year.

Estimating (by Weight Units). The relationship of weight to volume is not constant, for this reason, production and composition determinations are based on weight estimates, not on comparison of relative volumes. The weight unit method is an efficient means of estimating production and lends itself readily to self-training (see Appendix F). The method is based on the following:

(1) A weight unit is established for each plant species occurring on the area being examined.

(2) A weight unit can consist of part of a plant, an entire plant, or a group of plants, exhibit.

(3) The size and weight of a unit varies according to the kind of plant. For example, a unit of 5 to 10 grams is suitable for small grass or forb species. Weight units for large plants may be several pounds or kilograms.

(4) Other considerations include:

(a) Length, width, thickness, and number of stems, and leaves;

(b) Ratio of leaves to stems; and

(c) Growth form and relative compactness of species.

Procedure for establishing a weight unit for a species.

(1) Decide on a weight unit (in pounds or grams) that is appropriate for the species.

(2) Visually select part of a plant, an entire plant, or a group of plants likely to equal this weight.

(3) Harvest and weigh the plant material to determine actual weight.

(4) Repeat this process until the desired weight unit can be estimated with reasonable accuracy.

(5) Maintain proficiency in estimating by periodically harvesting and weighing to check estimates of production.

Instructions For Completing Vegetation Production Worksheet. Use the weight estimate form illustration 13 to record production data on the 10 weight estimate plots. If two sites occur at a point, identify the data collected on production worksheets as Ecological Site 1 or 2 for that point.

(1) Enter the acceptable plant symbol

(2) For plots 1 through 10 (p-1 to p-10) enter an estimate of the number of weight units by species occurring in the appropriate plot(s), or the estimated weight by species occurring in the plots. The weight unit number can be expressed numerically (e.g. 6, 11.5, etc). If weight by species is recorded, the number entered would be the total estimated weight for that species; for example, a number of 52 in p-3 would mean that 52 grams or lbs is the estimated weight for that species in plot 3.

DOUBLE SAMPLING - When used to determine a correction factor, circle the plot number that are clipped.

(3) This column represents the summarized total number of weight units, or weight, by species occurring in plots 1 through 10 as estimated by the data collector.

(4) If weight units are entered in the plot data (2) columns, complete this column by entering the weight unit weight by species used by the data collector. If weight by species was entered in the plot data (2) columns rather than weight units, leave this column blank.

(5) Enter the weight measure unit (grams or pounds) for the weight unit weight shown in column (4), or the summarized species weight listed in column (3).

(6) Enter the plot size used to estimate weight units, or weight by species. The plot sizes will be 9.6 ft^2, 96 ft^2, or .01 acre.

(7) The conversion factor (CF) to be entered **when 10 plots with the following size and unit of measure are**:

CF = 1.0 on 9.6 ft^2 plots where grams are the unit of measure

CF = .1 on 96 ft^2 plots where grams are the unit of measure

CF = 45.4 on 96 ft^2 plots where pounds are the unit of measure

CF = .022 on .01 acre plots where grams are the unit of measure

CF = 10 on .01 acre plots where pounds are the unit of measure

(8) ADW adjustment = air dry weight adjustment . Enter the appropriate air dry weight percent in decimal form from tables and charts that convert green weight to dry weight based upon various stages of growth.

(9) Populate this column only when ***current season's growth*** of plant species has been removed by grazing. Enter the amount, in decimal form (0.25, 0.40, 0.60, etc), which best reflects the percentage of the "***PLANT REMAINING***" after grazing utilization has occurred. For example, if a plant species averages 30% utilization in the production transect, the percentage of the plants remaining would be 70%. thus, the adjustment entered for that particular species would be (.70). Utilization may vary through the 10 plots, requiring an estimate of the average use to determine the adjustment.

(10) Enter the cumulative percent of growth (in decimal form) that has occurred up to the time plot data is collected. The values entered can reflect the growth curves for the site (as listed in some site descriptions), or be based upon locally developed growth curve data for each species.

When doubling sampling is used to determine a correction factor, data will be recorded in columns (11) through (13); otherwise these columns will be left blank.

(11) For each plant species occurring in the clipped plots, enter the total ***estimated weight*** (to nearest gram or pound) by multiplying the total weight units by the weight unit weight for all clipped plots.

(12) For each plant species occurring in the clipped plots, enter the ***total clipped (harvested) weight*** (to nearest gram or pound) for all clipped plots.

(13) To determine the correction factor, divide column (12) by column (11) for each species and enter to the nearest hundredth. A factor of 1 indicates the estimates are the same as the clipped weights. A factor below one 1 indicates estimates are high and a factor above 1 indicates estimates are low.

(14). This column represents the air dry reconstructed weight in pounds per acre after considering all conversion, correction and adjustment factors. Calculate pounds per acre (nearest pound) for each plant species by multiplying the number of weight units (3), times the weight of the individual weight unit (4), times the plot size conversion factor (7), times the air dry weight adjustment (8), times the clipped conversion factor (13): Divided by: [the utilization adjustment (9) times the growth adjustment (10)]. The formula is:

$$\text{Pounds per Acre} = \frac{\text{Columns (3) x (4) x (7) x (8) x (13)}}{\text{Columns (9) x (10)}}$$

Types of Weight Units. Two types of weight units weights can be established. The first is a reconstructed weight unit weight (WUW) by species in which the observed "green" weight is adjusted for percent of air-dry weight, percent growth, and utilization, by following the process shown on Illustration 13. Using this procedure, the established weight unit by species can remain the same for the entire field collection period. However, as phenological plant stage, % air-dry conversion, or utilization change throughout the season, the "reconstructed WUW" must be recalculated accordingly using updated adjustment percentages.

The second weight unit weight is also established from the "green" weight by species but can be changed, and generally is, rather than remaining constant as the season progresses. As the season progresses the estimator changes the species weight unit weight to a unit generally larger and/or weighing more. Following the estimates made by the data collector on the amount of weight units

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VEGETATION PRODUCTION WORKSHEET **Point NO._____** **SITE 1 or 2 (CIRCLE)**

Page 12 **ESTIMATED WEIGHT UNITS BY SPECIES**

PLANT SPECIES SYMBOL (1)	PLANT SPECIES COMMON NAME (OPTIONAL)	<----------(2)----------> P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9	P-10	TOTAL WT UNITS (3)	WT UNIT WT (4)	WT MEAS gm/lb (5)	PLOT SIZE (6)	<---------- ADJUSTMENTS ----------> PLOT SIZE CF (7)	ADW ADJ (8)	UTIL ADJ (9)	GWTH ADJ (10)	<---- DOUBLE SAMPLING ----> CLIP PLOTS EST WT (11)	CLIP PLOTS CLIP WT (12)	CLIP/ EST CF (13)	TOTAL WEIGHT LB/AC (14)

REMARKS:

Illustration 13

by species in the transect, the weight units and corresponding weights of those units are subject to adjustments, e.g. for % of air dry weight, % of growth, etc.

Estimating production and composition of a single plot.

(1) Estimate production by counting the weight units of each species in the plot.

(2) Convert weight units for each species to grams or pounds.

(3) Harvest and weigh each species to check estimates of production.

(4) Compute composition on the basis of actual weights to check composition estimates.

(5) Repeat the process until proficiency in estimating is attained.

(6) Periodically repeat the process to maintain proficiency in estimating.

(7) Keep the harvested materials, when necessary, for air-drying and weighing to convert from field (green) weight to air-dry weight.

Units of Production and Conversion Factors. Production data will ultimately be expressed as air-dry weight in pounds per acre (lbs/acre). To express production as air dry weight in pounds per acre, in most cases it will be necessary to apply a number of conversion, adjustment, and correction factors to the collected plot data. These include plot size conversions, converting green weight (field weights) to air-dry weight, making adjustments for grazing use (utilization), adjusting estimated production to a period of "peak of growth", and finally, determining a correction factor when double sampling is completed in the data collection process.

Plot Size Conversions: Because data will be collected in different weight measure units (grams or pounds) and in different plot sizes (9.6 ft^2, 96 ft^2, or .01 acre), conversion factors are necessary in convert the data to pounds per acre. The conversion factor (CF) **when 10 plots with the following size and unit of measure is**:

CF = 1.0 on 9.6 ft^2 plots where grams are the unit of measure

CF = .1 on 96 ft^2 plots where grams are the unit of measure

CF = 45.4 on 96 ft^2 plots where pounds are the unit of measure

CF = .022 on .01 acre plots where grams are the unit of measure

CF = 10 on .01 acre plots where pounds are the unit of measure

Converting Green Weight to Air-Dry Weight. The percentage of total weight that is air-dry weight for various types of plants at different stages of growth is provided in Appendix G. More locality specific air-dry weight conversions may be available through local offices of the BLM and NRCS

If air-dry weight percentage figures have not been previously determined and included in tables, retain and dry enough samples or harvested material to determine air-dry weight percentages. These percentages are based on currently available data and are intended for interim use. As additional data from research and field evaluations become available, these figures will be revised. Air-dry weight percentages listed in Appendix G can be used for other species having growth characteristics similar to those of the species listed.

The relationship of green weight of air-dry weight varies according to such factors as exposure, amount of shading, time since last rain, and unseasonable dry periods. It is important that a number of samples of plant material be harvested and air-dried each season to verify the factors shown or to establish factors for local use.

Adjustment for Grazing Use (Utilization): Production lost as a result of grazing use must be recognized and recreated in order to provide a more accurate estimate of the total current years annual production for individual species and the plant community. The grazing utilization adjustment attempts to restore this missing amount of production. The examiner determines the percent of the current years growth that remains. This is actually the reverse of percent utilized.

Adjustment for Growth: Using available growth curve information for both individual species and for the plant community as a whole (from site descriptions), this adjustment corrects the production data collected at a specific period of the year to the period of the year when "peak of production" is expected.

Double Sampling Correction Factor: Double Sampling is a process that involves estimating production followed by harvesting the production, then comparing the difference to compute the correction factor.

DEVELOPING RECONSTRUCTED WEIGHT UNIT WEIGHTS

Illustration 14

SPECIES	X Y Z										
EST. WEIGHT UNIT WEIGHT (1)	30										
% AIR DRY WT. (2)	0.40										
% OF GROWTH (3)	0.60										
% OF UNGRAZED PLANT (4)	1.0										
RECONSTRUCTED WU WEIGHT (5)	20 GM										

(1) Estimated Green Weight in Grams or Pounds of an Individual Species Weight Unit

(2) Conversion of Green Weight to Air Dry Weight Expressed as a Percent in Decimal Form

(3) the Amount of Growth Expressed as a Percent in Decimal Form, of Peak or Maximum Annual Growth for the Species

(4) the Reverse of Percent Utilization (Grazed Portion of Plants). Reflects the Remaining Amount of the Grazed Plant. For Example, If a Plant Was 30% Utilized Then 70% or .70 of the Plant Remains

(5) the Reconstructed Weight Unit Weight after Adjustments. Calculated as Follows:

$$\frac{\text{GREEN WU WEIGHT (1)} \quad \text{X} \quad \text{\% AIR DRY WEIGHT (2)}}{\text{\% OF GROWTH (3)} \quad \text{X} \quad \text{\% OF UNGRAZED PLANT (4)}}$$

Estimating and Harvesting (Double Sampling). The double-sampling method is to be used in making most production and composition determinations.

Double sampling will be completed under the following circumstances:

- on the first sample point each week
- any time examiners feel uncomfortable about their estimates.
- whenever data collection begins in a different Major Land Resource area
- any time it appears the phenological development of species has changed for example; forbs start blooming, or grasses start putting out seed heads.

The procedures for double sampling are:

(1) On a transect that will be double sampled, estimate and record the weight of each species in each plot by means of the weight-unit method. When estimating or harvesting plants, include all parts of plants whose stems originate in the plot, including all aboveground parts that extend beyond a plot boundary. Exclude all parts of herbaceous plants, shrubs, and trees whose stems originate outside a plot, even though their foliage may overlap into the plot.

(2) After weights have been estimated on all plots, select the plots to be harvested.

The plots selected should include all or most of the species in the estimated plots, if an important species occurs on some of the estimated plots but not on the harvested plots, it can be clipped individually on one or more plots.

The number of plots harvested depends on the number estimated. Research indicates at lease one plot should be harvested for each seven estimated to adequately correct the estimates. At least 2 plots are to be harvested for this study.

(3) Harvest, weigh, and record the weight of each species in the plots selected for harvesting. Harvest all herbaceous plants originating in the plot at ground level. Harvest all current leaf, twig, and fruit production of woody plants, originating in the plots.

(4) Correct estimated weights by dividing the harvested weight of each species by the estimated weight for the corresponding species on the harvested plots. This factor is used to correct the estimates for that species in each plot. A factor of more than 1.0 indicates that the estimate is low. A factor lower than 1.0 indicates that the estimate is high.

(5) After plots are estimated and harvested, correction factors for estimates computed, air-dry percentages are determined by air-drying the harvested materials or by selecting the appropriate factor from an air-dry percentage table, Appendix G. Values for each species are then corrected to air-dry pounds per acre or kilograms per hectare for all plots. Average weight and percentage composition can then be computed for the sample area.

Calculating Species Composition. Species composition is calculated comparing the production for a given year (favorable year, average year and unfavorable) with what the Potential Natural Community would produce in a similar year. Most ecological site description indicate the amount of production that is likely to occur on the site depending on the type of year (favorable year, average year and unfavorable). Each ecological site description also indicates a percentage range each species contributes to the production of the Potential Natural Community.

To determine allowable production for calculating species composition percentages for each species must be convert to Pounds per acre. The similarity index is calculated by dividing the allowable current production by the total expected for the site (ie.385/900=43%).

SPECIES COMPOSITION

Table 6

Species	% of PNC	Allowable Average year 900 lbs/acre	Current Prod
Western Wheat grass	10-20	90-180	160
Bluebunch Wheatgrass	10-20	90-180	80
Sandberg Bluegrass	10-20	90-180	0
Needleandthread grass	5-10	45- 90	25
Bottlebrush Squirreltail	5-10	45- 90	30
Prairie Jungrass	5-10	45- 90	20
Mutton Grass	5-10	45- 90	10
Blue Grama	1-5	45- 90	0
Salina Wildrye	1-5	45- 90	10
			335

385/900=37% Coefficient of similarity

NOXIOUS WEEDS AND SPECIAL STATUS PLANTS. Record species name and abundance rating for any state listed noxious weeds or special status plants that are encountered on the line intercept transect, the weight estimate plots, or in the 75 foot radius macroplot. If the noxious weed or special status species is encountered in the production plots it should also be rated for abundance. The primary purpose for this rating is to provide early warning of a noxious weed or to document the presence of a special status plant (Illustration 15). Abundance ratings are:

1. Rare.	Plants number less than 5 plants per macroplot
2. Sparse	Plants number 5-25 per macroplot
3. Scattered	Plants number 26-50 per macroplot
4. Common	Plants number 51-100 per macroplot
5. Abundant	Plants number 100 plus
6. Dominant	very few other plants are present

There are 69 species total species in Colorado these are shown on List "A" Appendix H. List "B" in Appendix H highlights the 10 species in Colorado that are the most widespread and cause the most economic damage. The "C" list contains 15 species that are not widespread in Colorado or not known to be present, but have the potential to do great environmental and economic damage. If a species on this list is not known in Colorado, it is found in at least one state that borders Colorado and is known to be spreading. For a listing of Special Status plants see Appendix I.

If you have questions concerning Colorado weed or special status plants, please contact Carol Spurrier, Colorado staff Botanist, at (303) 239-3725.

RANGELAND HEALTH. (Illustration 15)

1) Starting at the PSU point, mark a 75 ft. Radius circle with the point at the center.
2) Walk through the entire circle. Look at the condition within the circle with the rangeland health worksheet in mind.
3) Standing at the center of the circle, begin assessing the rangeland health attributes on the worksheet.
4) Walk through the circle as necessary to make the assessments on the worksheet.
5) Each attribute **must** be rated. Do not leave any attribute blank.

Preparation For Using The Rangeland Health Worksheet. There is a great deal of information available to assist in completing the rangeland health worksheet. The most helpful reference is the Rangeland Ecological Site Description. Rangeland Health is judged against this site description. The

rangeland Ecological Site Description is the standard. There are several things in the site description that are important to know. It is advisable to read the site description carefully prior to assessing the attributes on the rangeland health worksheet. The rangeland health attributes are compared to the rangeland ecological site description.

In general the aspect of the site, the soils section, and the discussion of retrogression and the interpretations sections of the site descriptions will help provide a picture of the the site and the functioning of the ecological processes on that site.

There are also some specific areas in the site description that give information necessary for assessing the attributes on the rangeland health worksheet. The production figures for the site during favorable years, average years, and unfavorable years, and percent cover are two sources of information. Be sure to review these aspects of the site carefully. They should give you valuable insights for evaluating the amount of bare ground, infiltration and runoff rates, distribution and amounts of litter, and potential production of the site. It is also important to study of the historic climax plant community. This is valuable in understanding the historic functional plant groups and invasive plants that occurred on the site.

Rangeland Health is an ecological rating that evaluates the current functioning of the ecological processes on an ecological site. Rangeland health determinations evaluate how the ecological processes, (water cycle & hydrology, nutrient cycle, energy flow, recovery mechanisms) are functioning relative to how the ecological processes functioned on the site under the historic climax plant community.

Rangeland Health is defined as: The degree to which the integrity of the soil, the vegetation, the water, and the air as well as the ecological processes of the rangeland ecosystem are balanced and sustained.

Integrity is defined as: Maintenance of the structure and functional attributes characteristic of a particular locale, including normal variability.

This Rangeland Health evaluation was developed to assess the rangeland health of a site for the NRI. Currently it is for the NRI only. The assessment is made by comparing the functioning of the ecological processes to that supported by the rangeland ecological sites as described in the rangeland ecological site description and knowledge based on observations and studies on the appropriate site. Much of the information needed is not readily available in the current site descriptions. However, using the combined resources of ecological site descriptions, reference areas and professional knowledge and expertise

about the ecology of the site generally provides sufficient information to make an informed determination of rangeland health.

All of the ecological attributes used in this rangeland health evaluation are of value as an indicator of some important ecological characteristic. The procedure used to evaluate rangeland health integrates the information provided by multiple attributes into a more comprehensive determination of the ecological status of the rangeland ecological site. For instance, attributes such as litter distribution, litter amount, soil surface and production, can be interpreted to tell something about nutrient cycling at the sample point. The health of an area of rangeland will be interpreted from the preponderance of evidence from all attributes evaluated at a sample point.

All rangeland health determinations are specific to a single rangeland ecological site. All attribute observations must be made within the boundary of the site. Some attributes can only be estimated by comparing current with the potential status as described in the site description. For example, you must know the potential production of the site before you can determine how closely the current production compares. Another example is that plant functional groups must be identified from the site description before assessing how the current situation compares. Benchmarks for some attributes such as crytobiotic crusts and litter distribution and amount are best evaluated after observing the attribute on reference areas for the site.

All of the attribute descriptions are written so that the Class I column represents the most degraded state for the attribute and the Class V column represents the ideal functioning of the attribute comparable to the functioning during the historic climax for the site. The selection of an attribute rating is done by comparing the condition of the attribute in the sample plot with the five attribute categories on the worksheet. The attribute rating is made by choosing the attribute description that most closely agrees with your observations in the sample plot. It is not necessary that all of the descriptions fit the site exactly. No one attribute by itself will determine the health status of a site. It is necessary to look at the preponderance of evidence to evaluate the health status of a site.

For example, you may step over an active gully to get to a sample plot, but the gully does not extend into the plot. You would select attribute category V for this situation since the gully was not present in the sampling plot. The statistical design of the NRI procedure is based on the premise that ultimately you will find a gully in a sample plot close to the proportions of gully occurrence within the site.

The results of this evaluation are not intended to be used for a site specific evaluation. The results form a site evaluation are aggregated to produce a

report on the integrity and functional status of the ecological processes on an MLRA, regional, state or national basis.

It is essential that a standard approach be used in evaluating and recording attribute ratings. The following descriptions provide supplemental information to assist field personnel in making consistent and accurate interpretations of the various attributes. Training is also essential for making accurate and consistent attribute ratings.

A worksheet has been created (Appendix J) to help in this rangeland Health assessment. It lists all the attributes and narratives describing each attribute in the 5 categories. Use the Rangeland Health form (illustration 15) to record the categories. Two tables are provide, on the form, in the event the sample area has more than one ecological site.

Ecological Attributes

Rills - Rills are the result of water erosion. They are small rivulets or gullies that form due to concentrated water flow across the soil surface. This attribute compares the current activity, development and interval of rills, caused by water, to that expected for the site.

Water Flow Patterns - Concentrated flow paths are where water accumulates on its path down slope. These may be well defined or almost invisible. They occur at irregular intervals and differ in size and frequency depending upon the degree of slope, cover, soils and intensity of rainfall event. They are rarely continuous, and will appear and disappear as the slope microtopography of the land changes.

Pedestals Caused by Erosion - Erosional pedestals are elevated soil units supporting plants, persistent litter or gravel/rocks caused by soil losses due to erosion. It can be very difficult to determine erosion from; frost heave, deposition of wind blown material, or litter fall. Active pedestals show sharp edges, and may show exposed roots.

Bare Ground - Bare ground is exposed mineral soil that is not covered by plants, litter, crytobiotic crust, rocks or gravel larger than ¼ inch in diameter. Do not count exposed bedrock, or surface rock. Soil covered by litter woody debris or live vegetation is not bare ground.

Gullies - A gully is a channel that has been cut into the soil by the action of running water. Some soils are inherently unstable and therefore may contain gullies even in their potential state. Natural flow patterns that have never eroded are not gullies.

Wind Erosion - Some sites are naturally erosive by the forces of wind. Compare the current evidence of wind erosion to that expected for the site when the historic climax plant community dominated the site.

Microbiotic Crusts - Cryptogamic crusts include species of lichen, algae, cyanobacteria, and moss that grow singly or in association on the soil surface on most rangelands. It does not include the club mosses and tundra. Identification is difficult and unnecessary since only crytobiotic crust presence and extent are important for this evaluation. Microbiotic crust plays a role in the stabilization of the soil surface, in infiltration of water, and in the mineral cycle.

Soil Surface - This attribute addresses the loss of the surface of the soil where the majority of the biological activity occurs. This may or may not be an "A" horizon. Soil surface is not synonymous with "A" horizon. It is the top surface of the soil where organic matter accumulation and decomposition begin to occur. This attribute is evaluated considering the depth and degree of coverage of the surface organic matter relative to the site potential.

Infiltration Capacity and Surface Runoff - The presence and effects of soil compaction, surface crusting caused by raindrop impact, and changes in plant composition and cover on infiltration capacity and surface runoff are evaluated. Signs of increased water flow patterns and pedestaling are also indicative of reduced infiltration capacity and increased surface runoff.

Plant Mortality - This attribute compares the proportion of dead or decadent perennial vegetation on the site to the amount expected for the site under the conditions that existed during the time the historic climax plant community dominated the site.

Functional Plant Groups - This attribute addresses the functional interrelationships among plants in the energy flow and mineral cycle. Functional plant groups on a site would include plant groupings related by their lifeform, size, rooting structure and the photosynthetic pathways. Examples of functional plant groups for a site might include: Warm season tall grasses (big bluestem, Indian grass), warm season mid grasses (blue grama, little bluestem), cool season mid grasses (western wheatgrass, green needlegrass), warm season short grass (buffalo grass), perennial forbs, evergreen shrubs, and deciduous shrubs. Shifting the proportions of cool season to warm season grasses will reduce photosynthetic efficiency since less leaf area will be present in early spring to harvest the sun's energy.

Another example of plant functional groups would include cool season tall grasses (basin wildrye), annual grasses (cheatgrass), annual forbs, CAM pathway plants (cacti), yucca, agave, etc., evergreen trees (western juniper),

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RANGELAND HEALTH

Ecological Site 1 Name_____ Ecological Site 2 Name _____

Enter class numbers I, II, III, IV, or V to each attribute

Ecological Site 1

Attribute		Class
Rills	1	
Water Flow Patterns	2	
Pedestals Caused by Erosion	3	
Bare Ground	4	
Gullies	5	
Wind Erosion	6	
Cryptobiotic Crust	7	
Soil Surface	8	
Infiltration & Runoff	9	
Plant Mortality	10	
Functional Plant Groups	11	
Litter Distribution	12	
Litter Amount	13	
Plant Stress	14	
Production	15	
Invasive Plants	16	
Recruitment & Reproduction	17	

Ecological Site 2

Attribute		Class
Rills	1	
Water Flow Patterns	2	
Pedestals Caused by Erosion	3	
Bare Ground	4	
Gullies	5	
Wind Erosion	6	
Cryptobiotic Crust	7	
Soil Surface	8	
Infiltration & Runoff	9	
Plant Mortality	10	
Functional Plant Groups	11	
Litter Distribution	12	
Litter Amount	13	
Plant Stress	14	
Production	15	
Invasive Plants	16	
Recruitment & Reproduction	17	

SPECIAL STATUS PLANTS - NAME	ABUNDANCE
01	
02	
03	
04	
05	

NOXIOUS & INVASIVE PLANTS - NAME	ABUNDANCE
01	
02	
03	
04	
05	

and deciduous trees (hackberry). The conversion of shrub steppe vegetation types (big sagebrush/cool season bunch grasses) into annual grasslands (cheatgrass) would be an example of a shift in the functional plant groups of a site.

A description of the functional groups can be constructed using the rangeland ecological site description, and compared to the existing functional groups on the site. It is important to identify those functional groups that are now present that were not present in the site description.

Litter Distribution - The distribution of the litter within the sample plot is evaluated. The intent of this attribute is to determine if the litter is moving around on the site or moving offsite.

Litter Amount - Amount of litter relative to the site potential and current climatic conditions is indicative of site protection from erosion and mineral cycling.

Plant Stress - Plant stress is evidenced by poor vigor, lower biomass production of perennial plants, susceptibility or infection with disease, and hedging on shrubs and trees. Short term stress is not expected to affect most perennial plants for more than 1 - 2 years while long term stress will require two or more years to complete recovery.

Production - This attribute deals with the total annual production of above ground vegetation. It is compared with the production values contained in the rangeland ecological site description and is relative to the current climatic conditions.

Invasive Plants - This attribute deals with plants that are invasive to a site. The invasive plants may or may not be state listed noxious weeds. They may or may not be exotic. They generally are invaders or increasers to the site that can and often do continue to increase regardless of the management, and will eventually dominate the site.

Recruitment or Reproduction - This attribute addresses the potential for plants to reproduce via seed or vegetatively and does not ask if young plants or seedlings are present. The attribute is rated by assessing the plants ability to produce seed or to reproduce asexually if the opportunity exist in a given year. germination or establishment of new plants are not rated.

TREE DATA. The objective of collecting tree data is to define the tree structure, to identify significant insect, disease, or health conditions, and to measure changes over time of the tree component of the vegetation. The expected

products are summaries of cover (transect) data and tree counts (plot) data by ecological site groups. (Illustration 16)

Collect tree data on the 10 one-hundredth (.01) acre production plots. A tree is "in" the plot if at least one-half of the base of the tree is within the plot.

Record all live trees first and then all standing dead trees. Observe each "in" tree and record the plot number, damage and severity code, height class, and tree count. All data elements are required except "severity code" for live trees. If live trees have no damage (code 01) there is no severity.

The tree data elements are:

Plot number (two numeric characters)

Species code (five alpha and two numeric characters)

Damage code (two numeric characters)

Severity code (two numeric characters)

Tree count (two numeric characters)

HEIGHT CLASS:

1 = less than 2.0 feet (.6 meters) tall
2 = 2.0 feet to 6.0 feet (1.8 meters) tall
3 = 6.0 feet to 16.0 feet (4.9 meters)
4 = 16.0 feet and greater

Note: Trees in height classes 1 and 2 may be recorded using a tree count other than 1. For example, all trees of the same species, same height class, and with no damage (or the same damage) may be counted and recorded as one entry.

TREE DAMAGE. The damage code indicates that some agent (activity, insect, disease) has or is interfering with the normal growth of a tree. Record damage when a shorter life span is expected or when an abnormal growth form of the tree occurs. If more than one agent is present, record the one considered most damaging.

Illustration 16

Colorado BLM 1997
Test Pilot Worksheet **PSU NUMBER** _ _ _ _ _ _ _ _ _ _ _ _

Page 13 **POINT NUMBER** ☐ **SITE 1 or 2 (CIRCLE)**

TREE DATA

Plot #	SPECIES	DAMAGE		TREE COUNT BY HEIGHT CLASS			
		Code	Severity	<2'	2' - 6'	6' - 16'	>16'

DAMAGE CODE:

	01	No damage.
Insect	10	Unidentified insect
	11	Bark beetles or engraver beetles
	12	Defoliators
Disease	20	Unidentified disease
	21	Rusts
	22	Heart rot/stem decay
	23	Cankers
	24	Mistletoe. A code 24 requires a "severity" entry.
	28	Root rot
	29	Foliage disease
Fire	30	Killed by fire.
	31	Fire damage. Record fire as a damage agent if the cambium is dead on one-half of the bole and/or if the scorched and dead branches extend into the top one-third of the crown.
Animal	40	Unidentified animal
	41	Domestic livestock
	42	Porcupine girdling
	43	Wildlife browse
	44	Other damage
Weather	50	Unidentified weather
	51	Wind
	52	lightning
Other	60	Killed by competition from other trees or vegetation.
	61	Suppressed or stunted by competition.
	70	Unknown cause of death.
	74	Dead crown. Use this code when the crown of a tree has a dead, or missing, top. For pinyon and juniper enter the code when one or more of the main branches is dead. A code 74 requires a "severity' entry.
	76	Unhealthy foliage, undetermined cause
	80	Human activity - Killed by logging, chaining, etc.

SEVERITY CODES.

Dead trees -	code 99
Mistletoe (damage 24) -	see the procedure in Appendix K
Dead top (damage 74) -	record the percentage of the crown which is dead

TREE IDENTIFICATION CODES

COMMON NAME	SCIENTIFIC NAME	CODE
Subalpine fir	Abies lasiocarpa	ABLA
Utah juniper	Juniperus osteosperma	JUOS
Rocky Mountain juniper	Juniperus scopulorum	JUSC2
Oneseed juniper	Juniperus monosperma	JUMO
Lodgepole pine	Pinus contorta	PICO
Common pinyon	Pinus edulis	PIED
Englemann spruce	Picea engelmannii	PIEN
Limber pine	Pinus flexilis	PIFL2
Bristlecone pine	Pinus aristata	PIAR
Southwest. white pine	Pinus strobiformis	PIST3
Ponderosa pine	Pinus ponderosa	PIPO
Blue spruce	Picea pungens	PIPU
Douglas-fir	Pseudotsuga menziesii	PSME
Other softwoods		OTHS
Rocky Mountain maple	Acer glabrum	ACGL
Water birch	Betula occidentalis	BEOC2
Cottonwood	Populus sp.	POPUL
Narrowleaf cottonwood	Populus angustifolia	POAN3
Aspen	Populus tremuloides	POTR5
Gambel oak	Quercus gambelii	QUGA
Oak	Quercus sp.	QUERC
Willow	Salix sp.	SALIX
Curlleaf mtn. mahogany	Cercocarpus ledifolius	CELE3
Alder-leaf mtn. Mahogany	Cercocarpus montanus	CEMO2
Other hardwoods		OTHH

GLOSSARY OF TERMS

-B-

blunted having an edge that is not sharp.

basal cover (area) the cross-sectional area of the stem or stems of a plant, or all plants in a stand. Herbaceous and small woody plants are measured at or near the ground level; larger woody plants are measured at breast or other designated height.

biomass the total amount of living plants and animals above and below ground in an area at a given time.

bole the trunk or main stem of a tree

browse (1) the part of shrubs, half shrubs, woody vines, and trees available for animal consumption; or (2) to search for or consume browse.

browse plant or browse species a shrub, half shrub, woody vine, or tree capable of producing shoot, twig, and leaf growth suitable for animal consumption.

brush management manipulating woody plant cover to obtain desired quantities and types of woody cover and/or to reduce competition with herbaceous understory vegetation, in accordance with ecologically sound resource management objectives.

bulk density the mass of dry soil per unit bulk volume. This value is expressed ad Mg per cubic meter.

-C-

canopy cover the percentage of ground covered by a vertical projection of the outermost perimeter of the natural spread of foliage of plants. Small openings within the canopy are included. Canopy cover is synonymous with crown cover.

community an assemblage of populations of plants and/or animals in a common spatial arrangement.

compaction layer The soil layer with increased bulk density and decreased soil porosity.. Soil compaction can result in poor infiltration and root development. Occurs because of mechanical forces on the soil

composition the proportions of various plant species in relation to the total on a given area. It may be expressed in terms of relative cover, relative density, relative weight, etc.

crust a hardened surface or organic layer on the soil surface.

cyanobacteria

-D-

decadence the lose in robustness and vigor in plants because they have not been grazed for long periods of time.

deposition the laying down or placing into position of sheets of sediment

dominant plant species or species groups, which be means of their number, coverage, or size, have considerable influence or control upon the conditions of existence of associated species.

downcutting

-E-

ecological attributes (rangeland health) Elements of an ecosystem used to assess processes that are too difficult or expensive to measure.

ecological site a kind of rangeland with a specific potential natural community and specific physical site characteristics, differing from other kinds of rangeland in its ability to produce vegetation and to respond to management. Ecological sites are defined and described with soil, species composition, and production emphasis. Ecological site is synonymous with range site and ecological type (FS).

ecological status the present state of vegetation of an ecological site in relation to the potential natural community for the site. Ecological status is use-independent. It is an expression of the relative degree to which the kinds, proportions, and amounts of plants in a community resemble that of the potential natural community. The four ecological status classes correspond to 0-25, 26-50, 51-75, or 76-100 percent similarity to the potential natural community and are called early-seral, mid-seral, late-seral, and potential natural community, respectively.

effervescence bubbling, hissing, and foaming as gases escape in reaction to soils being treated with dilute hydrochloric acid. The degree to which the chemical reaction occurs provides an indication of the level of calcium carbonate in the soil.

emergent hydophytes Erect, rooted, herbaceous angiosperms that may be temporarily to permanently flooded at the base but do not tolerate prolonged inundation of the entire plant.

emergent mosses Mosses occurring in wetlands, but generally not covered by water.

energy flow the entire process of capturing sunlight by green plants to produce food for their own use and organisms, the transfer of this energy to plant eaters and predators and finally the last useable energy is consumed by scavengers and decay.

eolian deposits earth material transported by the wind including dune sands, sand sheets, and loess.

estimated use the use made of forage on an area by wildlife, wild horses, wild burros, and/or livestock where actual use data are not available. Estimated use may be expressed in terms of animal unit months or animal months.

-F-

foliar cover the percentage of ground covered by a downward vertical projection of the aerial portion of plant foliage, excluding small openings in the canopy, Foliar cover is always less than canopy cover. Total foliar cover of all species may exceed 100 percent.

forb (1) any herbaceous plant other than those in the Gramineae (true grasses), Cyperaceae (sedges), and Juncaceae (rushes) families--i.e., any nongrass-like plant having little or no woody material on it; or (2) a broadleaved flowering plant whose stem, above ground, does not become woody and persistent.

forestland land on which the vegetation is dominated by trees. Lands are classified forestland if the trees now present will provide 25 percent or greater canopy cover at maturity. Lands not presently forestland that were originally or could become forested through natural succession may be classified as potential natural forestland.

friable a consistency term pertaining to the ease of crumbling of soils.

-G-

germination the beginning of growth in a seed, especially following a dormant period.

grass any plant of the family Gramineae.

grassland land on which the vegetation is dominated by grasses, grasslike plants, and/or forbs. Non-forested lands are classified as grassland if herbaceous vegetation provides at least 80 percent of the canopy cover excluding trees. Lands not presently grassland that were originally or could become grassland through natural succession may be classified as potential natural grassland.

grasslike plant a plant of the Cyperaceae or Juncaceae families which vegetatively resembles a true grass of the Gramineae family.

grazable woodland forestland on which the understory includes, as an integral part of the forest plant community, plants that can be grazed without detrimental impact to other forest values.

ground cover The percentage of material, other than bare ground covering the land surface. It may include live and standing dead vegetation, litter cobble, gravel, stones, and bedrock. Ground cover plus bare ground would total 100 percent.

-H-

half shrub a plant with a woody base whose annually produced stems die each year.

harvest the removal of plant material for weighing and/or later analysis (determining air dry weight).

hedging (1) the appearance of browse plants that have been browsed so as to appear artificially clipped; or (2) consistent browsing of terminal buds of browse species that results in excessive lateral branching and a reduction in upward and outward growth.

herbaceous vegetation growth with little or no woody component; nonwoody vegetation such as graminoids and forbs.

herbage the above-ground material of any herbaceous plant (grasses and forbs).

historic climax community

horizons a layer of soil or soil material approximately parallel to the land surface and differing from adjacent genetically related layers in physical chemical and biological properties or characteristics such as color, structure, texture, consistency, kind, and number of organisms present, degree of acidity or alkalinity.

hydrology the science dealing with the distribution and movement of water.

-I-

inventory the systematic acquisition and analysis of information needed to describe, characterize, or quantify resources for land-use planning and management of the public lands.

-L-

life-form characteristic form or appearance of a species at maturity, e.g., tree, shrub, herb, etc.

litter The uppermost layer of organic debris on the soil surface; essentially the freshly fallen or slightly decomposed vegetal material.

litter fall

-N-

native pasture Land on which native vegetation (climax or natural potential plant community) is forest but which is used and managed primarily for production of native plants for forage. Native pasture includes cutover forest land and forested areas that were cleared and used as cropland.

nickpoints A point of sharp change in slope, especially in the longitudinal profile of a stream or of its valley.

noxious weeds a plant species that is undesirable because it conflicts, restricts, or otherwise causes problems under management objectives. Not to be confused species declared noxious by laws concerned with plants that are weedy in cultivated crops and on range.

nutrient cycle the process in which microorganisms brakes down mineral from the soil and air and make it available for use by plant. Plant materials are returned to the soil surface as leaves, stems, branches, flowers, and seeds. Plant resides are then broken down into finer particles by fire, chemical weathering (oxidation), mechanical forces and biological activity where is becomes available again to microorganisms.

-O-

organic layer The soil layer with the highest concentration of organic material. Usually the surface layer.

overstory the upper canopy or canopies of plant, usually referring to trees, shrubs, and vines.

pasture a grazing area enclosed and separated from other areas by a fence or natural barrier.

parent material the unconsolidated and more or less chemically weathered mineral or organic matter from which the solum of soils is developed by soil forming process.

pedestaled a condition where the soil has eroded from around individual plants or other objects such as small rocks, leaving them on small pedestals of soil. Sometimes the result of frost heaving

perennial plant a plant that has a life span of 3 or more years.

permeability the easy with which gases, liquids, or plant roots penetrate or pass through a bulk mass of soil or a layer of soil.

persistent emergents Emergent Hydophytes whose leaves and stems beak down at the end of the growing season so that most above ground portions of the plants are easily transported by currents, waves or ice. The breakdown may result from normal decay or the physical force of strong waves or ice. At certain seasons of the year there are no visible traces of the plants above the surface of the water.

photosynthetic pathway

Plurality the greatest amount or largest quantity.

potential natural community (PNC) the biotic community that would become established if all successional sequences were completed without interferences by man under the present environmental conditions. Natural disturbances are inherent in development. PNCs can include naturalized non-native species.

proper grazing use the degree of utilization of current years growth which, if continued, will achieve management objectives and maintain or improve the long-term productivity of the site. Proper grazing use varies with time and systems of grazing.

public lands any land and interest in land outside of Alaska owned by the United States and administered by the Secretary of the Interior through the Bureau of Land Management. (see 43 CFR 4100.0-5).

-R-

range seeding the process of establishing vegetation by the artificial dissemination of seed.

rangeland a kind of land on which the native vegetation is predominantly grasses, grass-like plants, forbs, or shrubs. Includes lands revegetated naturally or artificially when routine management of that vegetation is through manipulation of grazing. (Rangelands include natural grasslands, savannas, shrublands, most deserts, tundra, alpine communities, coastal marshes, and wet meadows.

range site See ecological site.

recovery mechanisms

reference area Rangeland benchmark where ecological process (including site stability and biotic integrity) are functioning properly.

riparian zone the banks and adjacent areas of water bodies, water courses, seeps, and springs whose waters provide soil moisture sufficiently in excess of that otherwise available locally so as to provide a more moist habitat than that of contiguous flood plains and uplands.

rock fragment an individual fragment of solid mineral material which occurs naturally on the earth's crust and ranges in size from gravel to boulder.

root barrier a physical restriction to rooting

-S-

sample a set of sampling units, as opposed to a single measurement.

sampling unit units on which observations are made. They could be a finite point, plots or quadrats, distance measures, a weight unit, or a transect.

savanna a grassland with scattered trees, whether as individuals or clumps; often a transitional type between true grassland and forest.

seral community one of a series of biotic communities that follow one another in time on any given area. Seral community is synonymous with successional community.

seral stage the developmental stages of an ecological succession; synonymous with successional stage.

shrub a plant that has persistent woody stems and a relatively low growth habit, and that generally produces several basal shoots instead of a single bole. It differs from a tree by its low stature-less than 5 meters (16 feet)--and nonarborescent form.

shrubland land on which the vegetation is dominated by shrubs. Nonforested lands are classified as shrubland if shrubs provide more than 20 percent of the canopy cover, excluding trees. Lands not presently shrubland that were originally or could become shrubland through natural succession may be classified as potential natural shrubland.

solum a set of horizons that are related through the same cycle of soil development; A, E, and B horizons

special status plant a species that is either Federally listed as threatened or endangered, officially proposed (or a candidate) for Federal listing as threatened or endangered, State listed as threatened or endangered, or listed by a BLM State Director as sensitive.

steppe Semi-arid grassland characterized by short grasses occurring in scattered bunches with other herbaceous vegetation and occasional woody species.

stone descriptive term applied to rock fragment ground cover where the longest dimension measures 10- to 24-inches.

structure the subsoil property in which soil particles are arranged in a definite pattern or shape (granular, subangular blocky, angular blocky, platy, prismatic, columnar, massive, single grain.) Soil particles can be held together weakly, moderately, or strongly. The size can be very fine, fine, medium, coarse, and very coarse.

succession the orderly process of community change; it is the sequence of communities that replace one another in a given area.

successional community seral community.)

successional stage seral stage.)

-T-

terrace an earthen dike to retain water and diminish the potential of soil erosion. Created by the mechanical movement of soil along the horizontal contour of a slope.

tree a woody perennial, usually single-stemmed plant that has a definite crown shape and characteristically reaches a mature height of at least 5 meters (16 feet). Some plants, such as oaks (Quercus spp.), may grow as either trees or shrubs.

-U-

understory plants growing beneath the canopy of other plants; usually refers to grasses, forbs, and low shrubs under a tree or shrub canopy.

utilization the proportion or degree of current year's forage production by weight that is consumed or destroyed by animals (including insects). The term may refer either to a single plant species, a group of species, or the vegetation as a whole. Utilization is synonymous with use.

-V-

vegetation plants in general, or the sum total of the plant life above and below ground in an area.

vegetation type a kind of existing plant community with distinguishable characteristics described in terms of the present vegetation that dominates the aspect or physiognomy of the area.

vegetative tiller the asexual development of a new plant from a meristematic region of the parent plant.

vigor relates to the relative robustness of a plant in comparison to other individuals of the same species. It is reflected primarily by the size of a plant and its parts in relation to its age and the environment in which it is growing.

-W-

warm season species plants whose major growth occurs during the spring, summer, or fall and that are usually dormant in winter.

water cycle The process in which water condense in the atmosphere and falls as rain, snow, sleet, and hail. It is then absorbed into the soil where it is picked up by plant roots and transpired back into the atmosphere.

wetlands Areas characterized by soils that are usually saturated or ponded, i.e hydric soils, that support mostly water-loving plants (hydrophytic plants).

understory plants growing beneath the canopy of other plants; usually refers to grasses, forbs, and low shrubs under a tree or shrub canopy.

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-V-

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-W-

warm season species plants whose major growth occurs during the spring, summer, or fall and that are usually dormant in winter.

water cycle The process in which water condense in the atmosphere and falls as rain, snow, sleet, and hail. It is then absorbed into the soil where it is picked up by plant roots and transpired back into the atmosphere

wetlands Areas characterized by soils that are usually saturated or ponded, i.e hydric soils, that support mostly water-loving plants (hydrophytic plants).

PRECISE LIGHTWEIGHT GPS RECEIVERS (PLGR)
ABRIDGED USER'S GUIDE

USDA/NRCS

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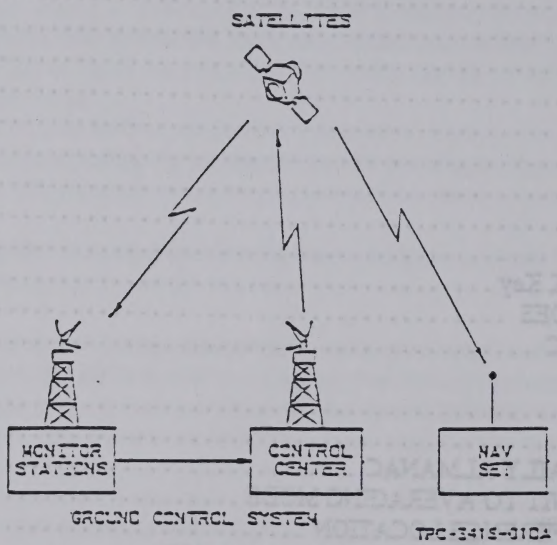
INTRODUCTION:

This abridged user's guide is intended to provide a quick means to become familiar wi of GPS receivers (PLGR) and does not replace the complete Operation and Maintenance Manua provided with each PLGR kit. The full Operation and Maintenance Manual should be read for detailed information on the use of the receiver. Appendix A in the full manual contains a glossa unfamiliar terms and acronyms. The main emphasis of this guide is to help get the user into the with the instrument to mark waypoints and to navigate to known waypoints. A waypoint is defi precise position on the earth's surface referenced to a coordinate system such as latitude/longitud UTM.



The PLGR are part of the NAVSTAR (Navigation System u Time and Ranging) system develo maintained by the military. A constellation of 24 earth orbiting s broadcast continuous signals that received by the PLGR. At any po time, 8 to 12 satellites are visible PLGR but only 5 satellite signals tracked to obtain a location or for navigation. Locations are determi the length of time it takes for a si leave the satellite and arrive at receiver (nanoseconds). These ti values are transformed into distan through internal geometric triangu Through this triangulation, the PL displays the location in a coordina system of the user's choice.

The NRCS has access to the restricted precise code under agreement with the Departmen Defense (DOD). This code allows NRCS to obtain "real time" accuracies not presently availabl public. The public uses the CA code that is subject to intentional distortions of up to 300 feet o Because of this agreement with DOD, ONLY NRCS EMPLOYEES ARE PERMITTED TO US PLGR.

The accuracy of the PLGR has been field checked in Minnesota. Accuracies of 2 to 10 not uncommon under favorable conditions. Favorable conditions include: a fully charged b constellation of satellites and full satellite visibility from the PLGR. Accuracies can be adverse affected when the satellites' visibility if blocked by tall objects or satellite geometry is not adeq

CAUTIONS:

There are certain actions you should not take with the PLGR. If you do, data will be lost or the unit will be very inaccurate. These actions will not occur by accident, so don't be concerned that you will accidently lose all data or cause the PLGR to become inaccurate.

DO NOT TAKE THE FOLLOWING ACTIONS!!

1. Do not "Zeroize". To zeroize you must push the "CLR/MARK" and "NUM LOCK" keys at the same time and then press the "OFF" button. This will destroy all data on the PLGR. See page 2-10, section 2.3.2.11 of O&M Manual on Zeroize for additional information if needed.

2. Do not lose the "CRYPTO" key. To lose the CRYPTO key you must be in the CRYPTO screens. The CRYPTO key is important for obtaining good accuracy of position but the screens dealing with the CRYPTO key are not needed by NRCS personnel to carry out their work. DON'T SCROLL THROUGH MENU AND SELECT CRYPTO!! This may cause loss of crypto key resulting in poor data and we will have to pay to have key reinstalled. See page 3-40 through 3-47 of O&M Manual for more information on CRYPTO if needed.

3. Do not remove the memory battery. The memory battery is located on the bottom of the PLGR. See page 1-7, figure 1-2 in the O&M Manual for the location of the memory battery.

4. Do not attach the PLGR to a computer with both the computer turned on and PLGR powered up. Attach the PLGR to the computer serial port with the receiver turned OFF.

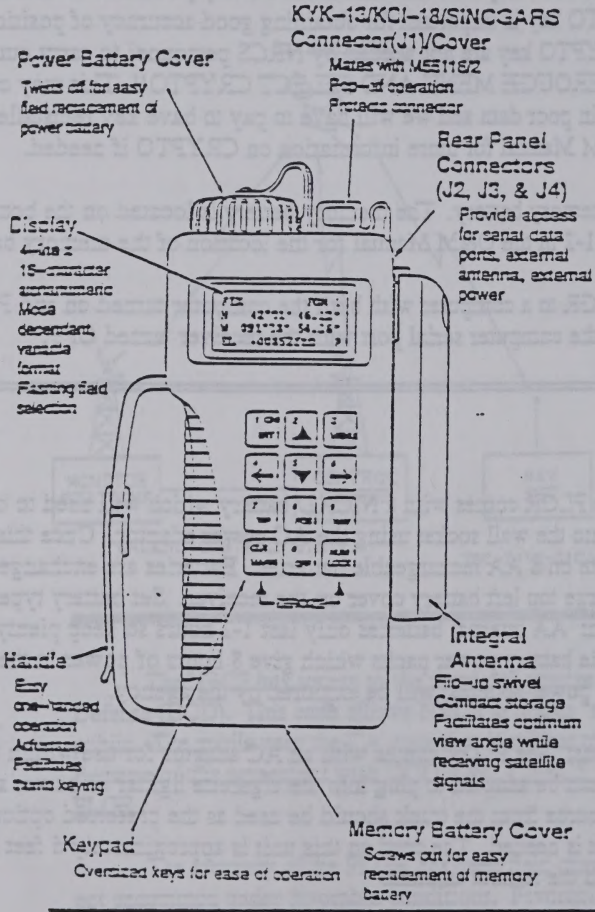
POWER SOURCES:

Internal battery: The PLGR comes with a NICAD battery which will need to be charged for 36 hours by plugging the unit into the wall socket using the AC power adaptor. Once this battery has expired the PLGR can operate on 8 AA rechargeable batteries. Batteries are exchanged using the AA battery holder through the large top left battery cover on the receiver. Set battery type and reset time in MENU->STATUS. Problem: AA internal batteries only last 1-2 hours so keep plenty of spares for long mission. New attachable battery power packs which give 8 hours of power in the field will also be available.. Other alternative power sources will be explored by the agency.

External power options: The PLGR comes with an AC adaptor for use within the office and an external power cable which can be adapted to plug into the cigarette lighter or power sources in the agency trucks. The power source from the truck should be used as the preferred option if you can drive to the location where the unit is needed. The cord on this unit is approximately 6 feet long with an additional length of cord with the remote antenna.

ANTENNA:

Each PLGR has two antennas. The integral antenna is the gray arm on the right side of the PLGR that is raised in an upright position when in use and lowered downward when stored. T external antenna is a magnetic 3 inch metal disk that is connected to the PLGR with a cable. It suggested to use an extendable paint/utility pole with a screw mount spec #10 screw, 32 threads per on the end to attach the external antenna. The pole lifts the antenna high enough to eliminate the us a source of GPS signal masking, reduces scattering from the ground, helps signal reception in brush areas and hopefully gives more accurate locational information.



KEYS:

All keys have two functions exc the "NUM LOCK" key. Pressing "NUM LOCK" will activate number keys and "N" will appear in the lower right of the screen. Pressing "NUM LOCK" again cause commands in white on the keys t active and a "P" will be shown in right of the screen.

The left- and right-arrow keys a used to move the cursor from field to fi in the display. They do not change the value of displayed data. The cursor is shown on the display as a blinking field The up- and down-arrow keys are used change display pages, change numeric field values, and activate functions. Th operation performed depends on what f is selected when the keys are pressed.

MENUS:

MENU Key: displays the system menu (items underlined are most often used)

SETUP - Allows user to select operating mode, coordinate system, units, and other operating and display parameters.

INIT - Allows user to initialize position, time, and date

OPS - Allows user to select the following functions:

DATA-XFR - Allows transfer of setups, time, waypoints, and satellite data to another handpack.

SV-SEL - Allows user to include or remove individual satellites for use by the handpack.

DOP-CALC - Used to command the handpack to calculate the best satellite geometry for a given time period.

ALERTS - Provides for set up and control of corridor, position error, and buffer alerts.

SINCGARS - Allows user to load TIME FILL data into a SINCGARS compatible radio.

TEST - Allows the user to command handpack self-test.

KOI-18 - Selects the KOI-18 paper tape reader load page.

USER-DEFS - Allows user to define datums, coordinate systems, and navigation displays.

HELP - Brings up the help displays.

STATUS - Provides system, battery, antenna, satellite, and other status information.

WP Key: brings up the waypoint menu display

ENTER - Enter the position, identifier, datum, and magnetic variation of waypoints.

EDIT - Edit or review the position, identifier, datum, and magnetic variation of waypoints.

COPY - Copy position, datum, and magnetic variation data from one waypoint to another.

SR-CALC - Calculate the coordinates of a new waypoint using slant range, azimuth, and elevation angle or waypoint elevation from either present position or from another waypoint.

RNG-CALC - Calculate the coordinates of a new waypoint using range, azimuth, and elevation angle (ELA) or waypoint elevation from either present position or from another waypoint.

DIST - Determine range, azimuth, and elevation angle from one waypoint to another.

CLEAR - Clear from memory a single waypoint or a range of waypoints.

ROUTE - Link together the legs of up to 15 routes using defined waypoints. Also allows a route to be copied or cleared.

POS Key:

Pressing the POS key brings up the position display. The position display is three pages that display current position, time, speed, and satellite tracking status. The last-used position page comes up when the POS key is pressed from another display.

NAV Key:

There must be waypoints loaded in the handpack when using the NAV key. The first pages select the nav method and destination waypoint. More pages are available to display the various waypoint and route nav information.

MARK Key:

The MARK key is used to store the present position as a waypoint. The first unused waypoint is automatically selected, but can be changed to any waypoint number.

NUM LOCK Key:

Pressing the NUM LOCK key toggles the keyboard between control mode and numeric mode. An N is displayed at lower right of display in the numeric mode.

OPERATING MODES:

FIX - In this mode the PLGR will take one reading after it has locked on the five acceptable satellites that have the appropriate coordinate geometry. After taking one reading it will go to standby (STBY) and track no further satellites.

CONT - In this mode the PLGR tracks satellites continuously, updating and changing the position once each second. The coordinate values will change as the PLGR is moved on the ground.

AVG - In this mode the PLGR will average each successive reading with subsequent readings to refine the coordinates of the point in question. Theoretically the AVG mode would give the most precise coordinate.

TIME - In this mode only the time is given, no coordinate locations are given.

STBY - In this mode the PLGR does not track satellites and is waiting further keying.

The receiver needs to be set to CONTINUOUS (CONT) mode for most operations. CONTINUOUS mode continually tracks all satellites in view then chooses the sequence of satellites th provide the best position. The receiver mode can be viewed in the upper left corner of the first positio page. If the receiver is in QUICK-FIX (FIX) mode it will lock onto five satellites and take one readin The error associated with a quick-fix is not considered good enough for natural resources data collection. Once a quick-fix has been determined the receiver goes into STANDBY (STBY) mode. STANDBY mode uses a minimum amount of power to maintain the last position on the screen and should be switched to when moving from point to point or the unit should be turned off to conserve battery power. The screen is updated once per second. In very low signal environments, such as unde dense foliage or around many tall buildings, use the Averaging (AVG) mode to acquire satellites. Thi increases the Handpack's ability to acquire and track satellites. This feature will also give you the mos accurate reading for setting up a reference location. The AVG mode will also require much more time to gather a more precise locational reading and cannot be moved during acquisition of data. The numb of satellites that the unit is locked onto can be checked through the POSITION page.

DAILY ALMANAC:

The first time the PLGR is turned on each day, known as a "cold start", the PLGR starts searching for SVS (Satellite Vehicles). The first information the PLGR receives from each satellite (health, ephemeris, etc.) is picked up from the CA-code signal. The PLGR looks for the best geomet among the SVs in view and locks on to them. Once the PLGR has locked on to a SV it switches to P-code or Y-code, depending on AS (anti-spoofing). If AS is on, the PLGR will switch to Y-code. If A is off, the PLGR will switch to P-code. There is no positioning or navigation difference if the PLGR i using P-code or Y-code because encrypted receivers accessing the Precise Positioning Service do no contend with SA (Selective Availability). Accuracy and precision will be the same. Once the almanac is loaded, the PLGR is ready to be used for locational data.

HOW TO

PLGR SETUP:

Use left & right arrow keys (<- & ->) to move between fields on the menu and the up & down arrow keys to choose / change a selection. Setting are saved when paged through and MENU key is pushed.

DISPLAY	LOCAL SETUP	SUBJECT TO CHANGE DUE TO APPLICATION
MENU Key	Brings up MENU selection	
<- move-> v select SETUP INIT OPS USER-DEFS HELP STATUS	Move to and select SETUP	
SETUP MODE: CONT Continuous POS and VEL update SV-TYPE: mixed vP	CONT mixed	AVG STBY
SETUP UNITS MGRS-New Metric Elev: meter MSL ANGL: Deg Mag vP	L/L-dms English feet MSL Deg Mag	UTM/UPC meter Datum True/Grid
SETUP MVAR TYPE: Calc vP	Calc	
SETUP ELHold: automatic TIME: Zulu ERR: FOM vP	automatic 06:00 Zulu LOC=Z-0500 +/- ft	
SETUP DTM:WGD WGS-84 AUTOMATIC OFF TIMER: 5 min vP	NAS-C Off	NAR
SETUP I/O SERIAL: Standard HAVEQUICK: Off 1PPS: Off vP	Standard Off Off	
SETUP AUTOMARK MODE: OFF WP001 30-06-94 1200Z REPEAT 0000 vP	Defaults OK	

ACQUIRING A DAILY ALMANAC:

Your receiver will not instantly obtain a precise and accurate position fix. You should be prepared to allow 15 to 21 minutes for the receiver to collect accurate position data. The receiver looks for a default set of satellites when first powered up after unpacking or lengthy storage. A good rule of thumb is that it will take longer to determine a precise position if the satellites in view are different from the receiver tracking defaults. The receiver must be set to CONTINUOUS (CONT) mode. The following table represents what you can expect to happen when you power up your receiver for the first time.

Elapse Time	Num Visible	Num Good	Num Locked	Error Spatial	Error Time	Code Status	Almanac Status
1 min	0	0	0	Old	> 10 ms	All CA	None
2 min	3	3	2	Old	> 10 ms	3 CA - 1 Y	None
3 min	3	3	3	Old	+/- 1 µs	1 CA - 3 Y	None
4 min	4	4	3	+/- 370 ft	+/- 1 µs	1 CA - 3 Y	None
5 min	4	4	4	+/- 370 ft	+/- 1 µs	1 CA - 3 Y	None
6 min	5	5	4	+/- 370 ft	+/- 1 µs	1 CA - 3 Y	None
7 min	6	6	4	+/- 360 ft	+/- 1 µs	1 CA - 3 Y	None
8 min	6	6	5	+/- 360 ft	+/- 1 µs	All Y	None
9 min	7	7	5	+/- 360 ft	+/- 1 µs	All Y	None
10 min	8	8	5	+/- 60 ft	+/- 100 ns	All Y	None
11 min	8	8	5	+/- 40 ft	+/- 100 ns	All Y	None
12 min	8	8	5	+/- 40 ft	+/- 100 ns	All Y	None
13 min	8	8	5	+/- 40 ft	+/- 100 ns	All Y	None
14 min	8	8	5	+/- 40 ft	+/- 100 ns	All Y	Age 1 Day
15 min							

Elapse Time - Number of minutes elapsed after power on.

Num Visible - Number of satellites visible to the receiver. Can be viewed by going to first POSITION page, then paging down to get to the TRACK/SEARCH page.

Num Good - Number of satellites visible to the receiver in good health. Can be viewed by going to first POSITION page, then paging to the TRACK/SEARCH page.

Num Locked - Number of satellites the receiver has signal lock on. Can be viewed by going to first POSITION page, then paging to the TRACK/SEARCH page.

Error Spatial - A FIGURE OF MERIT (FOM) error estimate in spatial units. Found in upper right corner of the first POSITION page. Units are plus or minus feet when setup is for that unit measurement. "Old" means that the error is too large to work with. The error can be as high as one to several miles when "Old" appear.

Error Time - A TIME FIGURE OF MERIT (TFOM) error estimate in time units. Can be viewed by going to first POSITION page, then paging to the TIME/DATE page. TIME FIGURE OF MERIT units are fractions of seconds when the receiver is setup to those units. The timing error is measured first in milliseconds (ms), then microseconds (µs), and finally nanoseconds (ns). The Operations Manual provides further details on FOM and TFOM.

Code Status - Status of which of the three possible signals the receiver is acquiring from the satellite. Can be viewed by pushing the "menu" key , then choose "status". Line three of the page shows the code status for all of the five possible satellites that can be locked onto.
CA - Course Acquisition code - the least accurate and precise signals. Available to all users.
P - Encrypted access code. Encryption is required to access this signal.
Y - Encryption with anti-spoofing turned on. Encryption is required to access this signal. Used randomly and variably among all of the satellites in the constellation.

Almanac Status - Status of the daily key and almanac download. Can be viewed by pushing the POS key then page down to the TRACK/SEARCH page.

SETTING THE UNIT TO AVERAGING MODE:

1. Press MENU key
2. Select SETUP and activate
3. Change SETUP MODE to STBY
4. Press MENU key
5. Activate (SETUP)
6. Change SETUP MODE to AVG
7. Press POS key (low signal search feature is in use)

Once the AVG mode is selected, the position page will display the averaging counter. The counter will begin to increment only after the Handpack has actually obtained a valid position fix. When using the Low Signal feature, DO NOT move the handpack. The search feature is NOT used if AVG mode is selected directly from any other tracking mode (ie: CONT, FIX...).

SET-UP OF A REFERENCE LOCATION:

1. Choose a well marked permanent location.
2. Load almanac and allow error to decrease to lowest setting.
3. Change setup to AVG mode (see previous instructions). Allow unit to average the position for approximately 15 minutes or until you see little change in the position displayed.
4. Record for reference location to be used whenever the unit is to be taken to the field.

CALCULATION OF SATELLITE GEOMETRY (PDOP):

The PDOP calculation is part of the error calculation for each individual waypoint collected. This initial reading at your office allows you to determine if the satellite geometry will be good enough to collect data with the GPS unit for the time indicated. There will be times when the satellite geometry may not be favorable to collecting accurate data in the field. A good PDOP reading does not necessarily mean that when you get to the field you will get a low error reading. Other factors can affect the error reading.

1. MENU Key -> OPS -> DOP-CALC
2. Set start time and time interval you will be in the field for calculation. If you will be out all day, do at least two separate calculations. One for the morning and one for the afternoon. There maybe a problem with the satellite geometry for Arkansas in the afternoon which does not allow for good reading between 1-3 PM.

   PDOP Readings:

   1 -> 4 Excellent conditions for data collection
   4 -> 6 Good conditions for data collection
   6 -> 8 Okay or fair conditions for data collection
   > 8 Should not try to collect data at this time

DETERMINE CURRENT LOCATION AND MARK WAYPOINTS:

PUSH	REMARKS
POS Key	Indicates present position
When error indicator in top right of screen is at it's lowest value mark position	
MARK Key	Indicates the next waypoint to be marked (may be changed)
MARK Key	Waypoint is stored.

Can store up to 999 waypoints. You can use the waypoint # to collect and associate information about the location.

ENTER/EDIT WAYPOINTS:

PUSH	REMARKS
WP Key	
ENTER EDIT	Assign unused number or waypoint number to be edited
NUM LOCK Key	Activates number keys
Using number keys, enter three digits (eg. 008) of the waypoint	
NUM LOCK Key	Activates control keys
	Can enter a short label
	Some entries are changed with the number keys and some with the v down arrow key
WP Key	Waypoint will be stored

DETERMINE DISTANCE/DIRECTION BETWEEN WAYPOINTS:

PUSH	REMARKS
WP Key	
DIST	
NUM LOCK Key	Enter numbers of two waypoints (ie. 003, 010)
NUM LOCK Key	Distance and direction between two waypoints stored will be displayed.
MENU Key	to get out

NAVIGATION TO A KNOWN POINT FROM PRESENT LOCATION:

The PLGR will allow navigation from your current position to a known waypoint. The known waypoint must be stored as a waypoint number in the receiver or must be entered into the receiver before beginning to navigate.

PUSH	REMARKS
NAV Key	
TO/FROM WAYPOINT	# will be flashing
NUM LOCK Key	First digit of # will be flashing, enter 3 digits of the waypoint to which you wish to navigate.
NUM LOCK Key	Activate control keys
vP	Screen will display navigation as you have set it up.

Now as you move, your settings will change as you get nearer or further away from the destination. To customize the nav display pages, select and activate the NAV DISPLAYS function from the MENU, USER-DEFS menu. See page 4-11 and glossary in full manual for descriptions of options available for use in setting up your navigation display pages. The ability to find or get close to the desired location is dependent on the error reading (EPE) of the unit and the capabilities of the user. The EPE as discussed previously will give the user a measure of conditions which affect the units ability to acquire positional data.

Recommended Setup:

RNG	Range
STRCd	Steering 2 Dimensional
EPE	Estimated Position Error
ELD	Elevation Difference

PLGR+ REMOTE CONTROL/MISSION PLANNING STATION SOFTWARE:

The Mission Planning Station software NRCS version 2.0 will handshake with PLGR+, will download data from the PLGR+ and can be loaded on any 386 or greater computer. MPS NRCS version 2.0 can also be installed on the DOS partition of any 386 or greater computer running AT&T Unix 3.2 and Simultask.

Installation and use of the software to download files from PLGR:

1. Start the beta-test version of the RC/MPS for PLGR+ by installing it under DOS, not a DOS shell from within WINDOWS. It MUST be installed in the root of either the C:\ or D:\ drives.

2. After installation of the software is complete, attach the PLGR to the computer serial port with the receiver turned OFF. Execute the program by entering the command MPS_PLUS then turn on the receiver.

3. To request waypoints from the PLGR+ receiver, select MISSN (F3), ENTER (F7), Receiver (F3). Select Waypoints & Route by moving the highlight to that field and pressing ENTER.

4. Move the highlight to the Start Waypoint field and enter the starting waypoint number, default is 1. You may enter any waypoint number from 1 to 999. Press ENTER.

5. This action moves the highlight to the End Waypoint field. Enter the ending waypoint, the default is 999. You may enter any waypoint number from 1 to 999 that is greater than or equal to the starting waypoint. Press ENTER. This moves the highlight to the Initiate Receiver field. To request a single waypoint, enter it's number as both the starting and ending waypoint numbers. Press ENTER to start the data transfer from the PLGR+ to the PC.

6. After the selected waypoints have been transferred you will be prompted with the option to save mission data. Press ENTER to bypass this because the data saved is in another format. Press ESC to return to Screen 1.2, as shown in upper right of the screen.

7. To store the waypoint data to an ASCII file, press NAV (F3), WP (F3), FILE (F6). Enter the file name in which you wish to store the data. It will be placed in the C:\MPS_PLUS\FILE\ directory as filename.TXT. The file contains one waypoint per line, with data items separated by commas.

8. The user may at this point also change the format (such as from latitude/longitude to UTM) of the location data collected by changing the setup (under MENU -> SETUP) to the required coordinate type then downloading the file a second time under a new file name. File(s) are transferred to a 3-1/2" floppy disk with the DOS copy command.

9. The waypoints that delineate a linear feature or an area should be downloaded into separate files for each individual feature. If the readings from the field are for more than one application they need to be in different files. For example, points gathered for well locations and gypsy moth traps on the same day. They would be put into two separate files.

PRE-PLANNING PROJECT MISSIONS:

When planning to use the GPS unit, one must determine what is needed by the application to acquire and download the proper data in the proper format. Planning ahead will give you less problems in the long run. These questions would be answered by information from the topographic map of the area or the individual/agency for whom one is gathering the data. Questions that need to be answered before the mission are the following.

1. What is the feature type? point, line or area
   a. Point - A point is used to represent features for which only one geographic location is needed.
      examples: well site, utility pole, tree
   b. Line - A line is made up of a series of connected points.
      examples: stream, road, irrigation canal
   c. Area - A polygon is an area enclosed by lines
      examples: soil mapping units, wetlands, fields
2. What is the coordinate system? usually UTM or L/L-dms
3. What is the unit of measurement for elevation? usually meter or feet
4. What is the vertical base needed? datum (vertical map datum) or MSL(mean sea level)
5. What is the map datum? will be either NAD27 (NAS-C) or NAD83 (NAR)
6. How will the resulting waypoints be reported? digitally or manually

TASKS WHICH SHOULD BE DONE AT THE OFFICE BEFORE TAKING UNIT TO THE FIELD:

1. Check setup of GPS unit and status of power supply.
2. Acquire daily almanac.
3. Read and record reference point.
4. Calculate and record PDOP for time of recording locations in the field. Do a minimum of two calculations for a day, one for the morning hours and one for the afternoon hours.

TIPS:

1. Never take a reading where the error is greater than +/-30 ft or FOM of 1. I don't recommend taking a reading where the error is greater than +/-50 ft. The lower the error reading the more accurate your data. If unit positional error does not come into tolerance, satellite geometry may be wrong or the line of sight to the satellites may be obstructed. Problems with the satellite geometry have been reported for the times between 1->3 PM for Arkansas.

2. When taking points along a line or around an area, take a reading when you deviate from a straight line. Take more points around curved areas. Do not take readings closer than 1/2 your estimated position error (EPE) indicated in the upper right corner of your position page.

Exhibit 618-16 USDA Texture, Modifiers, and Terms Used in Lieu of Texture.

Texture Modifiers		Texture Terms		Terms used in lieu of texture	
BY	Bouldery	COS	Coarse sand	CE	Coprogenous earth
BYV	Very bouldery	S	Sand	CEM	Cemented
BYX	Extremely bouldery	FS	Fine sand	CIND	Cinders
CB	Cobbly	VFS	Very fine sand	DE	Diotomaceous earth
CBA	Angular cobbly	LCOS	Loamy coarse sand	FB	Fibric material
CBV	Very cobbly	LS	Loamy sand	FRAG	Fragmental material
CBX	Extremely cobbly	LFS	Loamy fine sand	G	Gravel
CN	Channery	LVFS	Loamy very fine sand	GYP	Gypsiferous material
CNV	Very channery	COSL	Coarse sandy loam	HM	Hemic material
CNX	Extremely channery	SL	Sandy loam	ICE	Ice or frozen soil
FL	Flaggy	FSL	Fine sandy loam	IND	Indurated
FLV	Very flaggy	VFSL	Very fine sandy loam	MARL	Marl
FLX	Extremely flaggy	L	Loam	MPT	Mucky-peat
GR	Gravelly	SIL	Silt loam	MUCK	Muck
GRC	Coarse gravelly	SI	Silt	PEAT	Peat
GRF	Fine gravelly	SCL	Sandy clay loam	SG	Sand and gravel
GRM	Medium gravelly	CL	Clay loam	SP	Sapric material
GRV	Very gravelly	SICL	Silty clay loam	UWB	Unweathered bedrock
GRX	Extremely gravelly	SC	Sandy clay	VAR	Variable
MK	Mucky	SIC	Silty clay	WB	Weathered bedrock
PF	Nonconsolidated permafrost	C	Clay		
PT	Peaty				
RB	Rubbly				
SR	Stratified				
ST	Stony				
STV	Very stony				
STX	Extremely stony				

New terms used in lieu of texture for NASIS

APUM	Ashy-pumiceous
ASHY	Ashy
ASK	Ashy-skeletal
CNDY	Cindery
CPF	Consolidated permafrost (ice rich)
HPUM	Hydrous-pumicious
HSK	Hydrous-skeletal
HYDR	Hydrous
MEDL	Medial
MPUM	Medial-pumiceous
MSK	Medial-skeletal
PUM	Pumiceous

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GRX	Extremely gravelly	SC	Sandy clay	VAR	Variable
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CNDY	Cindery
CPF	Consolidated permafrost (ice rich)
HPUM	Hydrous-pumiceous
HSK	Hydrous-skeletal
HYDR	Hydrous
MEDL	Medial
MPUM	Medial-pumiceous
MSK	Medial-skeletal
PUM	Pumiceous

Structure

Soil structure refers to units composed of primary particles. The cohesion within these units is greater than the adhesion among units. The term structural unit is used for any repetitive soil body that is commonly bounded by planes or zones of weakness that are not an apparent consequence of compositional differences. The examination is made in place or after the soil has been gently disturbed, such as by tapping a spade containing a slice of soil against a hard surface or dropping a large fragment on the ground.

No structure units may be observable. Such soil may be either single grain or massive. Single grain soil on rupture consists of 50 percent or more discrete mineral particles and the mass overall is very friable, soft or loose. Massive soil material is structureless and does not meet the criteria for single grain.

Shape, size, and grade (distinctness) of structural units are described.

Shape

platy: The units are flat and platelike. They are generally oriented horizontally and are usually overlapping.

prismatic: The individual units are bounded by flatish vertical faces. Units are distinctly longer vertically. Vertices are angular or subrounded; the tops of the prisms are somewhat indistinct and normally flat.

columnar: The units are bounded by flat or slightly rounded vertical faces. The tops of columns are very distinct and normally rounded.

blocky: The units are blocklike. They are bounded by flat or slightly rounded surfaces that are casts of the faces of surrounding peds.

granular: The units are approximately spherical or polyhedral and are bounded by curved or very irregular faces that are not casts of adjoining peds.

Size

Size Classes of Soil Structure

Size Classes	Shape of structure: Platy mm	Prismatic, Columnar mm	Blocky mm	Granular mm
Very Fine[a/]	<1	<10	<5	<1
Fine[a/]	1-2	10-20	5-10	1-2
Medium	2-5	20-50	10-20	2-5
Coarse[b/]	5-10	50-100	20-50	5-10
Very Coarse[b/]	≥10	≥100	≥50	≥10

a/ Platy structure is thin and very thin respectively.
b/ Platy structure is thick and very thick respectively.

Expression of structure

Grade describes the distinctness.

weak: The units are barely observable in place. When gently disturbed, the soil material parts into a mixture of whole and broken units and much material that exhibits no planes of weakness. Faces that indicate persistence through wet-dry-wet cycles are evident if the soil is handled carefully.

moderate: The units are evident in undisturbed soil. The soil material parts into a mixture of many whole units, some broken units, and material that is not part of units. If peds are present, they part from adjoining peds to reveal nearly entire faces that have properties distinct from those of fractured surfaces.

strong: The units are distinct in undisturbed soil. When removed, the soil material separates mainly into whole units. If peds are present, they have distinctive surface properties.

The relationship of cohesion within units to adhesion between units determine expression of structure. For example, structural units of a sandy loam horizon may have strong structure, yet they may be less durable than weak structural units that are silty clay loam. The degree of disturbance required to determine structure grade is highly variable. Only slight disturbance may be necessary to separate the units of strong granular structure, while considerable disturbance may be required to separate strong blocky structure.

Surface characteristics of units are described separately. Special structural units, such as the wedge-shaped units of Vertisols, are described in appropriate terms.

Compound Structure

Smaller structural units may be held together to form larger units. Grade, size, and shape are given for both and the relationship of one set to the other is indicated: "strong medium blocks within moderate coarse prisms," or "moderate coarse prismatic structure parting to strong medium blocky."

TERMS FOR ROCK FRAGMENTS

SHAPE AND SIZE	CODE AND NOUN
Round Classes	
2.0 - 7.6 cm diameter	Gravel
0.2 - 0.5 cm diameter	GRF - Fine Gravel
0.5 - 2.0 cm diameter	GRM - Medium Gravel
2.0 - 7.6 cm diameter	GRC - Coarse Gravel
7.6 - 25.0 cm diameter	CB - Cobble
25 - 60.0 cm diameter	ST - Stone
> 60 cm diameter	BY - Boulder
Flat Classes	
0.2 - 15 cm long	CN - Channer
15.0 - 38 cm long	FL - Flagstone
38.0 - 60 cm long	STF - Stone
> 60 cm long	BYF - Boulder

Expression of structure

Grade describes the distinctness:

weak: The units are barely observable in undisturbed soil. When gently disturbed, the soil material is a mixture of whole and broken units and much material that exhibits no planes of weakness. Faces that indicate persistence through wet-dry or freeze-thaw are evident if the soil is handled carefully.

moderate: The units are evident in undisturbed soil. The soil material parts into a mixture of many whole units, some broken units, and material that is part of units. If peds are present, they part from adjoining peds to reveal nearly entire faces or surfaces distinct from those within the peds.

strong: The units are distinct in undisturbed soil. When removed, the soil material parts mainly into whole units. If peds are present, they part to distinctive surface properties.

The relationship of cohesion within units to adhesion between units determines expression of structure. For example, structural units of a sandy loam may have strong structure, yet they may be less durable than weak structural units that are silty clay loam. The degree of disturbance required to determine structure grade is highly variable. Only slight disturbance may be necessary to separate the units of strong granular structure, while considerable disturbance may be required to separate strong blocky structure.

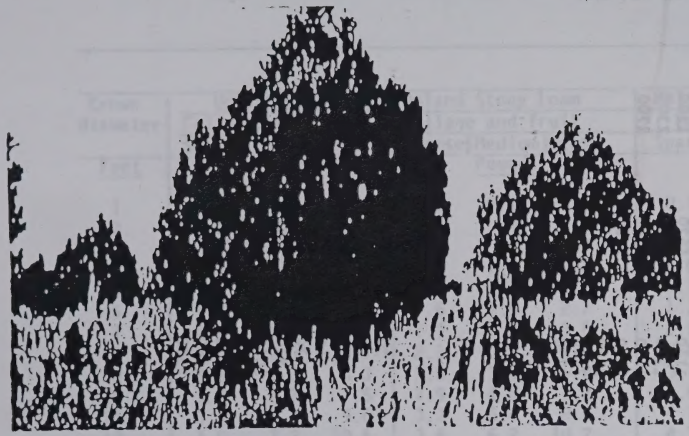
Surface characteristics of units are described separately. Special structural units, such as wedge-shaped units of Vertisols, are described separately.

Compound Structure

Smaller structural units may be held together to form larger units. Grade, size, and shape are given for both and the relationship of one set to the other is indicated: "strong medium blocks within moderate coarse prisms," or "moderate coarse granular structure parting to strong medium blocky."

FOLIAGE DENSENESS CLASSES

DENSE



MEDIUM

SPARSE

INSTRUCTIONS FOR USE OF TABLES

Determining yields of Juniper and Pinon pine by use of tables.

Two methods can be used:

1. On 1/10 or 1/100 acre plots selected by random, tally crown diameter per tree and foliage denseness (sparse, medium, and dense) on each tree. From the tables, find yield per tree for each tree by crown diameter and foliage denseness from the proper table (range site), and record this opposite each tree. Add this column of weights. Multiply by 10 on 1/10 acre plots and by 100 on 1/100 acre plots. This figure is pounds per acre annual yield.

2. On 1/10 or 1/100 acre plots selected by random, tally crown diameter and foliage denseness for each tree. Average the crown diameter for the dense foliage trees; likewise, for the medium and sparse separately. Find the weight per tree in the proper tables opposite for average crown diameter and multiply this figure by the number of trees in the foliage class. Do this for each foliage class. Add the three figures. Multiply by 10 on 1/10 acre plots and by 100 on the 1/100 acre plots to get yield per acre.

APPENDIX E

GUIDE FOR DETERMINING CURRENT YIELD OF UTAH JUNIPER IN UTAH

UPLAND STONY LOAM (JUNIPER) SITE

CURRENT YIELD AIR DRY POUNDS

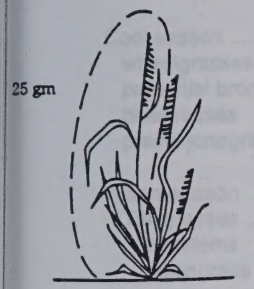
Crown Diameter Feet	Weight Per Tree	10 Trees	50 Trees	100 Trees	200 Trees	300 Trees	400 Trees	500 Trees
				Sparse Foliage				
1	0.1	1	5	10	20	30	40	50
2	0.3	3	15	30	60	90	120	150
3	0.6	6	30	60	120	180	240	300
4	1.0	10	50	100	200	300	400	500
5	1.3	13	65	130	260	390	520	650
6	1.6	16	80	160	320	480	640	800
7	1.9	19	95	190	380	570	760	950
8	2.3	23	115	230	460	690	920	1150
9	2.6	26	130	260	520	780	1040	1300
10	2.9	29	145	290	580	870	1160	1450
11	3.3	33	165	330	660	990	1320	1650
12	3.6	36	180	360	720	1080	1440	1800
13	4.0	40	200	400	800	1200	1600	2000
14	4.4	44	220	440	880	1320	1760	2200
15	4.7	47	235	470	940	1410	1880	2350
16	5.1	51	255	510	1020	1530	2040	2550
17	5.5	55	275	550	1100	1650	2200	
18	5.8	58	290	580	1160	1740	2320	
19	6.2	62	310	620	1240	1860	2480	
20	6.6	66	330	660	1320	1980	2640	
				Medium Foliage				
1	0.1	1	5	10	20	30	40	50
2	0.3	3	15	30	60	90	120	150
3	0.6	6	30	60	120	180	240	300
4	1.0	10	50	100	200	300	400	500
5	1.4	14	70	140	280	420	560	700
6	1.9	19	95	190	380	570	760	950
7	2.5	25	125	250	500	750	1000	1250
8	3.1	31	155	310	620	930	1240	1550
9	3.8	38	190	380	760	1140	1520	1900
10	4.6	46	230	460	920	1380	1840	2300
11	5.4	54	270	540	1080	1620	2160	2700
12	6.2	62	310	620	1240	1860	2480	
13	7.2	72	360	720	1440	2160		
14	8.1	81	405	810	1620	2430		
15	9.1	91	455	910	1820	2730		
16	10.2	102	510	1020	2040			
17	11.3	113	565	1130	2260			
18	12.4	124	620	1240	2480			
19	13.6	136	680	1360				
20	14.8	148	740	1480				
				Dense Foliage				
1	0.1	1	5	10	20	30	40	50
2	0.3	3	15	30	60	90	120	150
3	0.7	7	35	70	140	210	280	350
4	1.2	12	60	120	240	360	480	600
5	1.9	19	95	190	380	570	760	950
6	2.7	27	135	270	540	810	1080	1350
7	3.6	36	180	360	720	1080	1440	1800
8	4.7	47	235	470	940	1410	1880	2350
9	5.9	59	295	590	1180	1770	2360	
10	7.2	72	360	720	1440	2160		
11	8.6	86	430	860	1720	2580		
12	10.2	102	510	1020	2040			
13	11.9	119	595	1190	2380			
14	13.7	137	685	1370	2740			
15	15.6	156	780	1560				
16	17.7	177	885	1770				
17	19.9	199	995	1990				
18	22.2	222	1110	2220				
19	24.6	246	1230	2460				
20	27.2	272	1360	2720				

ANNUAL FOLIAGE AND FRUIT PRODUCTION PER JUNIPER TREE ON DIFFERENT SITES
AND FOR DIFFERENT FOLIAGE CLASSES

Crown diameter	Site: Upland Loam, Foliage and fruit			Upland Stony Loam, Foliage and fruit			Upland Gravelly Loam, Foliage and fruit			Upland Shallow Loam, Foliage and fruit			Upland Shallow Hardpan, Foliage and fruit		
	Sparse	Medium	Dense	Sparse	Medium	Dense	Sparse	Medium	Dense	Sparse	Medium	Dense	Sparse	Medium	Dense
Feet	Pounds			Pounds			Pounds			Pounds			Pounds		
1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.2
2	.2	.3	.4	.4	.3	.3	.4	.4	.5	.2	.2	.5	.3	.4	.5
3	.4	.6	.9	.7	.6	.7	.6	.7	.9	.4	.5	1.0	.7	.9	1.4
4	.6	1.1	1.5	1.0	1.0	1.2	1.0	1.1	1.5	.7	.8	1.6	1.2	1.6	2.4
5	.9	1.6	2.1	1.3	1.4	1.9	1.3	1.6	2.1	1.0	1.3	2.2	1.8	2.6	3.8
6	1.3	2.1	3.1	1.6	1.9	2.7	1.7	2.1	2.7	1.4	1.8	2.9	2.7	3.7	5.4
7	1.6	2.8	4.0	1.9	2.5	3.6	2.1	2.6	3.5	1.7	2.4	3.8	3.6	5.0	7.4
8	2.0	3.5	5.1	2.3	3.1	4.7	2.6	3.2	4.3	2.2	3.1	4.6	4.7	6.5	9.6
9	2.5	4.3	6.3	2.6	3.8	5.9	3.1	3.9	5.1	2.6	3.8	5.6	6.0	8.2	12.2
10	3.0	5.2	7.6	2.9	4.6	7.2	3.6	4.6	6.0	3.1	4.6	6.6	7.4	10.1	15.1
11	3.5	6.2	9.0	3.3	5.4	8.6	4.1	5.3	7.0	3.6	5.5	7.6	9.0	12.1	18.2
12	4.0	7.2	10.5	3.6	6.2	10.2	4.7	6.1	8.0	4.2	6.5	8.8	10.7	14.4	21.7
13	4.6	8.3	12.1	4.0	7.2	11.9	5.2	6.9	9.1	4.7	7.6	9.9	12.6	16.9	25.5
14	5.2	9.4	13.9	4.4	8.1	13.7	5.8	7.8	10.2	5.3	8.7	11.2	14.6	19.5	29.6
15	5.9	10.6	15.6	4.7	9.1	15.6	6.5	8.7	11.3	6.0	9.9	12.4	16.7	22.4	33.9
16	6.5	11.9	17.5	5.1	10.2	17.7	7.1	9.6	12.5	6.6	11.1	13.8	19.0	25.5	38.6
17	7.2	13.2	19.4	5.5	11.3	19.9	7.8	10.5	13.7	7.3	12.4	15.1	21.5	28.7	43.6
18	8.0	14.6	21.5	5.8	12.4	22.2	8.4	11.5	15.0	8.0	13.8	16.6	24.1	32.1	48.9
19	8.7	16.1	23.7	6.2	13.6	24.6	9.1	12.5	16.3	8.7	15.3	18.0	26.9	35.5	54.5
20	9.5	17.6	26.0	6.6	14.8	27.2	9.8	13.6	17.6	9.5	16.8	19.6	29.8	39.5	60.4

AMOUNT FOLIAGE AND FRUIT PRODUCTION PER JUNIPER TREE ON DIFFERENT SITES AND FOR DIFFERENT FOLIAGE CLASSES

Crown diameter	Site											
	Upland sandy loam				Upland stony loam				Upland gravelly loam			
	Foliage and fruit				Foliage and fruit				Foliage and fruit			
	Sparse	Medium	Dense	Sparse	Sparse	Medium	Dense	Sparse	Sparse	Medium	Dense	Sparse
	Pounds				Pounds				Pounds			
Feet												
1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.2	-0.1
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	.8	1.1	1.5	1.0	1.0	1.2	1.0	1.1	1.0	1.5	1.7	1.6
5	.9	1.6	2.1	1.3	1.4	1.9	1.7	1.6	2.1	1.0	1.3	2.5
6	1.3	2.1	3.1	1.6	1.5	2.7	1.7	2.1	2.7	1.4	1.8	2.9
7	1.6	2.8	4.0	1.9	2.5	3.6	2.1	2.6	3.5	1.7	2.4	3.8
8	[illegible]	[illegible]	[illegible]	2.3	3.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	5.3	7.6	3.0	4.0	[illegible]	[illegible]	5.1	[illegible]	[illegible]	[illegible]	[illegible]
10	3.0	5.2	7.6	2.9	4.6	5.7	3.6	4.6	6.6	3.1	4.6	7.4
11	3.5	6.5	9.0	3.4	5.6	8.6	4.1	5.3	7.6	3.6	5.5	9.0
12	4.0	7.2	10.5	3.6	6.2	10.2	4.7	6.1	8.9	4.2	6.5	10.7
13	[illegible]	8.1	12.1	4.0	7.2	11.7	5.2	6.9	9.9	4.7	7.6	12.6
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	5.9	10.6	15.6	4.7	9.1	14.7	6.9	8.1	11.3	5.9	9.9	17.4
16	6.5	11.9	17.5	5.1	10.2	17.7	7.1	9.0	12.5	6.5	11.1	11.0
17	7.2	12.2	19.4	5.5	11.3	19.3	7.8	10.0	14.7	7.3	12.4	15.1
18	8.0	15.6	21.5	5.8	12.4	22.7	8.4	11.0	15.0	8.0	13.6	16.6
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	9.5	17.6	25.0	[illegible]	[illegible]	[illegible]	9.8	13.4	17.6	[illegible]	16.0	19.5



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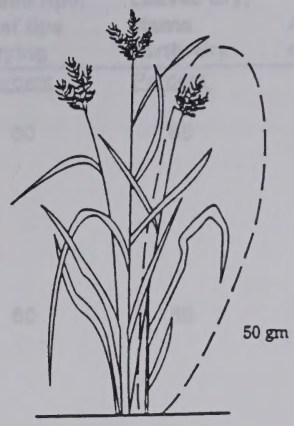

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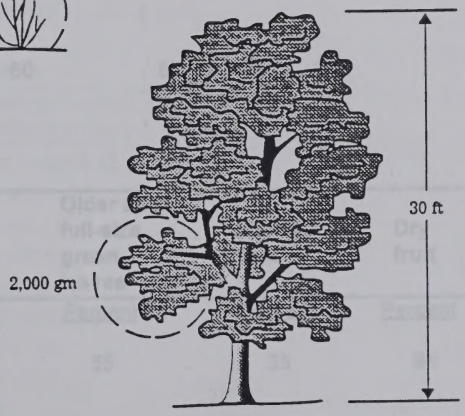

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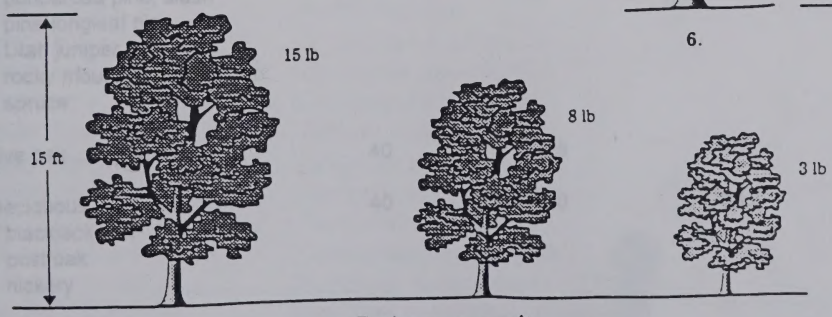


Entire tree as unit

7.

PERCENTAGE OF AIR-DRY MATTER IN HARVESTED PLANT MATERIAL AT VARIOUS STAGES OF GROWTH

GRASSES	Before heading; initial growth to boot stage	Headed out; boot stage to flowering	Seed ripe; leaf tips drying	Leaves dry; stems partly dry	Apparent dormancy
	Percent	Percent	Percent	Percent	Percent
Cool season	35	45	60	85	95
wheatgrasses					
perennial bromes					
bluegrasses					
prairie junegrass					
Warm-season					
Tall grasses	30	45	60	85	95
bluestems					
indiangrass					
switchgrass					
Mid grasses	40	55	65	90	95
side-oats grama					
tobosa					
galleta					
Short grasses	45	60	80	90	95
blue grama					
buffalograss					
short three-awns					

TREES	New leaf and twig growth until leaves are full size	Older and full-size green leaves	Green fruit	Dry fruit
	Percent	Percent	Percent	Percent
Evergreen coniferous.....	45	55	35	85
ponderosa pine, slash				
pine-longleaf pine				
Utah juniper				
rocky mountain juniper				
spruce				
Live oak	40	55	40	80
Deciduous	40	50	35	85
blackjack oak				
post oak				
hickory				

PERCENTAGE OF AIR-DRY MATTER IN HARVESTED PLANT MATERIAL AT VARIOUS STAGES OF GROWTH

SHRUBS	New leaf and twig growth until leaves are full size	Older and full-size green leaves	Green fruit	Dry fruit
	Percent	Percent	Percent	Percent
Evergreen	55	65	35	85
big sagebrush				
bitterbrush				
ephedra				
algerita				
gallberry				
Deciduous	35	50	30	85
snowberry				
rabbitbrush				
snakeweed				
Gambel oak				
mesquite				
Yucca and yucca-like plants ...	55	65	35	85
yucca				
sotol				
saw-palmetto				

FORBS	Initial growth to flowering	Flowering to seed maturity	Seed ripe; leaf tips dry	Leaves dry; stems drying	Dry
	Percent	Percent	Percent	Percent	Percent
Succulent	15	35	60	90	100
violet					
waterleaf					
buttercup					
bluebells					
onion, lilies					
Leafy	20	40	60	90	100
lupine					
lespedeza					
compassplant					
balsamroot					
tickclover					
Fibrous leaves or mat ...	30	50	75	90	100
phlox					
mat eriogonum					
pussytoes					

SUCCULENTS	New growth pads and fruits	Older pads	Old growth in dry years
	Percent	Percent	Percent
Pricklypear and barrel cactus	10	10	15+
cholla cactus	20	25	30+

APPENDIX H

The State Noxious Weed List

A. The following weed species, listed in alphabetical order, are identified as the State Noxious Weeds. They have been identified by individual counties as problem weeds in the county's area or have been recommended for management through public testimony.

African rue	(*Peganum harmala*)
Black henbane	(*Hyoscyamus niger*)
Black knapweed	(*Centaurea nigra*)
Black nightshade	(*Solanum nigrum*)
Blue mustard	(*Chorispora tenella*)
Bouncingbet	(*Saponaria officinalis*)
Bull thistle	(*Cirsium vulgare*)
Camelthorn	(*Alhagi pseudalhagi*)
Canada thistle	(*Cirsium arvense*)
Chicory	(*Cichorium intybus*)
Chinese clematis	(*Clematis orientalis*)
Coast tarweed	(*Madia sativa*)
Common burdock	(*Arctium minus*)
Common groundsel	(*Senecio vulgaris*)
Common mullein	(*Verbascum thapsus*)
Common St. Johnswort	(Hypericum perforatum)
Common tansy	(*Tanacetum vulgare*)
Common teasel	(*Dipsacus fullonum*)
Cypress spurge	(*Euphorbia cyparissias*)
Dalmatian toadflax	(*Linaria dalmatica*)
Dame's rocket	(*Hesperis matronalis*)
Diffuse knapweed	(*Centaurea diffusa*)
Downy brome	(*Bromus tectorum*)
Dyer's woad	(*Isatis tinctoria*)
Field bindweed	(*Convolvulus arvensis*)
Field sandbur	(*Cenchrus pauciflorus*)
Flixweed	(*Descurainia sophia*)
Green foxtail	(*Setaria viridis*)
Hairy nightshade	(*Solanum sarrachoides*)
Halogeton	(*Halogeton glomeratus*)
Hoary cress	(*Cardaria draba*)
Houndstongue	(*Cynoglossum officinale*)
Johnsongrass	(*Sorghum halepense*)
Jointed goatgrass	(*Aegilops cylindrica*)
Kochia	(*Kochia scoparia*)

Leafy spurge	(*Euphorbia esula*)
Longspine sandbur	(*Cenchrus longispinus*)
Mayweed chamomile	(*Anthemis cotula*)
Mediterranean sage	(*Salvia aethiopis*)
Musk thistle	(*Carduus nutans*)
Myrtle spurge	(*Euphorbia myrsinites*)
Oxeye daisy	(*Chysanthemum leucanthemum*)
Perennial pepperweed	(*Lepidium latifolium*)
Plumeless thistle	(*Carduus acanthoides*)
Poison hemlock	(*Conium maculatum*)
Puncturevine	(*Tribulus terrestris*)
Purple loosestrife	(*Lythrum salicaria*)
Quackgrass	(*Elytrigia repens*)
Redstem filaree	(*Erodium cicutarium*)
Rush skeletonweed	(*Chondrilla juncea*)
Russian knapweed	(*Centaurea repens*)
Russian thistle	(*Salsola collina*)
Russian thistle	(*Salsola iberica*)
Saltcedar	(*Tamarix parviflora*)
Saltcedar	(*Tamarix ramosissima*)
Scentless chamomile	(*Anthemis arvensis*)
Scotch thistle	(*Onopordum acanthium*)
Scotch thistle	(*Onopordum tauricum*)
Spotted knapweed	(*Centaurea maculosa*)
Squarrose knapweed	(*Centaurea virgata*)
Sulfur cinquefoil	(*Potentilla recta*)
Velvetleaf	(*Abutilon theophrasti*)
Wild caraway	(*Carum carvi*)
Wild mustard	(*Brassica kaber*)
Wild proso millet	(*Panicum miliaceum*)
Yellow foxtail	(*Setaria glauca*)
Yellow nutsedge	(*Cyperus esculentus*)
Yellow starthistle	(*Centaurea solstitialis*)
Yellow toadflax	(*Linaria vulgaris*)

B. The following weed species are recognized as the top ten prioritized weed species for the State of Colorado. After analysis of a statewide survey of counties, these species are acknowledged to be the most widespread and to cause the greatest economic impact in the State of Colorado.

Canada thistle	(*Cirsium arvense*)
Diffuse knapweed	(*Centaurea diffusa*)
Field bindweed	(*Convolvulus arvensis*)

Hoary cress	(*Cardaria draba*)
Jointed goatgrass	(*Aegilops cylindrica*)
Leafy spurge	(*Euphorbia esula*)
Musk thistle	(*Carduus nutans*)
Russian knapweed	(*Acroptilon repens*)
Spotted knapweed	(*Centaurea maculosa*)
Yellow toadflax	(*Linaria vulgaris*)

C. The following weed species may not be present or are not yet widespread or causing great economic impact within the State of Colorado.

African rue	(*Peganum harmala*)
Black knapweed	(*Centaurea nigra*)
Bouncingbet	(*Saponaria officinalis*)
Camelthorn	(*Alhagi pseudalhagi*)
Coast tarweed	(*Madia sativa*)
Common St. Johnswort	(*Hypericum perforatum*)
Common teasel	(*Dipsacus fullonum*)
Cypress spurge	(*Euphorbia cyparissias*)
Dyer's woad	(*Isatis tinctoria*)
Myrtle spurge	(*Euphorbia myrsinites*)
Rush skeletonweed	(*Chondrilla juncea*)
Scentless chamomile	(*Anthemis arvensis*)
Squarrose knapweed	(*Centaurea virgata*)
Sulfur cinquefoil	(*Potentilla recta*)
Yellow starthistle	(*Centaurea solstitialis*)

Leafy spurge	(*Euphorbia esula*)
Longspine sandbur	(*Cenchrus longispinus*)
Mayweed chamomile	(*Anthemis cotula*)
Mediterranean sage	(*Salvia aethiopis*)
Musk thistle	(*Carduus nutans*)
Myrtle spurge	(*Euphorbia myrsinites*)
Oxeye daisy	(*Chrysanthemum leucanthemum*)
Perennial pepperweed	(*Lepidium latifolium*)
Plumeless thistle	(*Carduus acanthoides*)
Poison hemlock	(*Conium maculatum*)
Puncturevine	(*Tribulus terrestris*)
Purple loosestrife	(*Lythrum salicaria*)
Quackgrass	(*Elytrigia repens*)
Redstem filaree	(*Erodium cicutarium*)
Rush skeletonweed	(*Chondrilla juncea*)
Russian knapweed	(*Centaurea repens*)
Russian thistle	(*Salsola collina*)
Russian thistle	(*Salsola iberica*)
Saltcedar	(*Tamarix pentandra*)
Saltcedar	(*Tamarix ramosissima*)
Scentless chamomile	(*Anthemis arvensis*)
Scotch thistle	(*Onopordum acanthium*)
Scotch thistle	(*Onopordum tauricum*)
Spotted knapweed	(*Centaurea maculosa*)
Squarrose knapweed	(*Centaurea virgata*)
Sulfur cinquefoil	(*Potentilla recta*)
Velvetleaf	(*Abutilon theophrasti*)
Wild caraway	(*Carum carvi*)
Wild mustard	(*Brassica kaber*)
Wild proso millet	(*Panicum miliaceum*)
Yellow foxtail	(*Setaria glauca*)
Yellow nutsedge	(*Cyperus esculentus*)
Yellow starthistle	(*Centaurea solstitialis*)
Yellow toadflax	(*Linaria vulgaris*)

B. The following weed species are recognized as the top ten prioritized weed species for the State of Colorado. After analysis of a statewide survey of counties, these species are acknowledged to be the most widespread and to cause the greatest economic impact in the State of Colorado.

Canada thistle	(*Cirsium arvense*)
Diffuse knapweed	(*Centaurea diffusa*)
Field bindweed	(*Convolvulus arvensis*)

Species Common Name	Scientific Name	Status[1]	Designation and Ranking of other Agencies and Groups[1] (CDOW Regional Occurrences)	Species Code[2]	Occurrence[3] BLM Districts and Resource Areas			
					Craig	Montrose	Canon City	Grand Junction
PLANTS								
Mancos milkvetch	*Astragalus humillimus*	FE	S. Montezuma county (Ute Mtn Reservation) G1, S1	ASHU		SJ		
Osterhout milkvetch	*Astragalus osterhoutii*	FE	Middle Park (Grand County) G1, S1	ASOS	KR			
Clay-loving wild buckwheat	*Eriogonum pelinophilum*	FE	Critical habitat designated Austin-Montose, G5, S2	ERPE		UN		
Penland Alpine Fen Mustard	*Eutrema penlandii*	FT	Park County, Co, G1, S1	EUPE10			RG	
Dudley Bluffs bladderpod	*Lesquerella congesta*	FT	Piceance Basin, Rio Bianco County, G1, S1	LECO6?	WR			
Knowlton cactus	*Pediocactus knowltonii*	FE	SE LaPlata County (UTE Mtn. Reservation), G1, S1	PEKN		SJ		
Pendland beardtongue	*Penstemon penlandii*	FE	Middle Park (Grand County) G1, S1	PEPE ?				
North Park phacelia	*Phacelia formosula*	FE	Walden (Jackson County) G1, S1	PHFO2 ?	KR			
Piceance (Dudley's Bluff) twinpod	*Physaria obcordata*	FT	Piceance Basin (Rio Blanco County), G2, S2	PHOB?	WR			
Unita Basin hookless cactus	*Sclerocactus glaucus*	FT	Mesa, Delta, Garfield County G3, S3	SCGL		UN		GJ, GS
Mesa Verde cactus	*Sclerocactus mesae-verdae*	FT	S. Montezuma County (UTE Mtn. Reservation), G2, S2	SCME		SJ		
Rydberg's columbine (Golden)	*Aquilegia chrysanta* var. *rydbergii*	BLMS	G4, T3, SH	AQCHRY			RG*	
Crandall rock-cress	*Arabis crandallii*	BLMS		ARCR5				
Gunnison milkvetch	*Astragalus anisus*	BLMS	G3, S2	ASAN4		GN		
Cushion milkvetch	*Astragalus aretioides*	BLMS	G3, S2	ASAR3				
Brandegee milkvetch	*Astragalus brandegei*	BLMS	G5, S1, S2	ASBR5			SL*	
Debris milkvetch	*Astragalus detritalis*	BLMS	G3, S2	ASDET5				
Mancos milkvetch	*Astragalus humillimus*	FE	S. Montezuma county (Ute Mtn Reservation) G1, S1	ASHU		SJ		
Starveling milkvetch	*Astragalus jejunus*	BLMS	G3, S1	ASJE2				

APPENDIX I

Species Common Name	Scientific Name	Status[1]	Designation and Ranking of other Agencies and Groups[1] (CDOW Regional Occurrences)	Species Code[2]	Occurrence[3] BLM Districts and Resource Areas			
					Craig	Montrose	Canon City	Grand Junction
Grand Junction milkvetch	*Astragalus linifolius*	BLMS	G2, S2	ASLI5		UN		GJ
Dragon milkvetch	*Astragalus lutosus*	BLMS	Not considered a rare plant G4, S3, S4	ASLU2				GJ, GS
Ferron milkvetch	*Astragalus musiniensis*	BLMS	G3, S1	ASMU3				GJ
Naturita milkvetch	*Astragalus naturitensis*	BLMS	G2, S2, S3	ASNA		UN, SJ		GS
Nelson milkvetch	*Astragalus nelsonianus*	BLMS	G3, S1	ASNE3				
Osterhout milkvetch	*Astragalus osterhoutii*	FE	Middle Park (Grand County) G1, S1	ASOS	KR			
Sandstone milkvetch	*Astragalus sesquiflorus*	BLMS	G3, S1?	ASSE7				
Wetherill milkvetch	*Astragalus wetherillii*	BLMS	G3, S3	ASWE2		UN**		GJ, GS
Tufted cats-eye	*Cryptantha casepitosa*	BLMS	G3, S2	CRCA7				
Osterhout cats-eye	*Cryptantha osterhoutii*	BLMS	G3, S1, S2	CROS				GJ
Rollins cats-eye	*Cryptantha rollinsii*	BLMS	G4, S2	CRRO5				
Uinta Basin spring-parsley	*Cymopterus duchesnensis*	BLMS	G3, S1	CYDU				
Kat buckwheat	*Eriogonum acaule*	BLMS	G3, S1	ERAC3				
NCN	*Eriogonum coloradense*	BLMS	G3, S2	ERCO11				
Ephedra wild buckwheat	*Eriogonum ephedroides*	BLMS	G3, S1	EREP				
Clay-loving wild buckwheat	*Eriogonum pelinophilum*	FE	Critical habitat designated Austin-Montose, G5, S2	ERPE		UN		
Tumor buckwheat	*Eriogonum tumulosum*	BLMS	G3, S2	ERTU2				
Little green buckwheat	*Eriogonum viridulum*	BLMS	G4Q, S1	ERVI11				
Snowy prairie gentian	*Eustoma grandiflorum*	FC-2	G5, S3	EUGR4				
Penland Alpine Fen Mustard	*Eutrema penlandii*	FT	Park County, Co, G1, S1	EUPE10			RG	
Colorado butterflyweed	*Gaura neomexicana ssp. coloradensis*	FC	population recently found near Ft Collins, G4, T2, S1	GANE2			RG	
Utah Gentian	*Gentianella tortuosa*	BLMS	G3, S1	GETO3				
Narrowstem gilia	*Gilia stenothyrsa*	BLMS	G3, S1	GIST2				GJ
Dudley Bluffs bladderpod	*Lesquerella congesta*	FT	Piceance Basin, Rio Bianco County, G1, S1	LECO6?	WR			

Species Common Name	Scientific Name	Status[1]	Designation and Ranking of other Agencies and Groups[1] (CDOW Regional Occurrences)	Species Code[2]	Occurrence[3] BLM Districts and Resource Areas			
					Craig	Montrose	Canon City	Grand Junction
Eastwood desert parsley	*Lomatium eastwoodiae*	BLMS	G3, S2, S3	LOEA				GJ, GS
Eastwood monkey flower	*Mimulus eastwoodiae*	BLMS	G3, S1, S2	MIEA		UN, SJ		GJ
Nuttall's sandwort	*Minuartia nuttallii*	BLMS	G5, S1	ARNU4				
Small-flowered nama	*Nama densum var. parviflorum*	BLMS	G5, S1	NADEP				
Ligulate feverfew	*Parthenium ligulatum*	BLMS	G3, S2	PALI6				
Knowlton cactus	*Pediocactus knowltonii*	FE	SE LaPlata County (UTE Mtn. Reservation), G1, S1	PEKN		SJ		
Paradox scurf pea	*Pediomelum aromaticum*	BLMS	G3, S2	PSAR2		UN		GJ
Parachute penstemon	*Penstemon debilis*	FC	G1, S1	PEDE22				GS
Graham beardtongue	*Penstemon grahamii*	FC	G2, S2	PEGR6	WR			GJ*
White River penstemon	*Penstemon scariosus* var. *albifluvis*	FC	G4, T2, S1	PESCA	WR			
North Park phacelia	*Phacelia formosula*	FE	Walden (Jackson County) G1, S1	PHFO2 ?	KR			
Debeque phacelia	*Phacelia submutica*	FC	G4, T2, ST	PHSU6				GJ, GS
Piceance (Dudley's Bluff) twinpod	*Physaria obcordata*	FT	Piceance Basin (Rio Blanco County), G2, S2	PHOB?	WR			
Mesa Verde cactus	*Sclerocactus mesae-verdae*	FT	S. Montezuma County (UTE Mtn. Reservation), G2, S2	SCME		SJ		
Capitate chicken-sage	*Sphaeromeria capitata*	BLMS	G3, S1	SPCA8				
Ute ladies'-tresses	*Spiranthes diluvialis*	FT	Boulder, Jefferson County G2, S2	SPDI6	WR*	UN*, SJ*		GJ*
Hanging garden sullivantia	*Sulivantia hapemanii* var. *purpusii*	BLMS	G3, T3, S3	SUPU				GJ, GS
Strigose Eastern-daisy	*Townsendia strigosa*	BLMS	G4, S1	TOST				
Andy's clover	*Trifolium andinum*	BLMS	G3, S1	TRAN2				
Ute ladies'-tresses	*Spiranthes diluvialis*	FT	Boulder, Jefferson County G2, S2	SPDI6	WR*	UN*, SJ*		GJ*

[1] STATUS: The source used to assign status is from:

Colorado's Natural Heritage: Rare and Imperiled Animals, Plants, and Natural Communities; Vol.1, No.1, 5/1995.

Colorado's Threatened, Endangered, Special Concern, Undetermined Status List; 7/95. (Paper from J. Sheppard)

AGENCY: *US Fish and Wildlife Service*

FE - Federally Endangered

FT - Federally Threatened

FC - Federal Candidate, substantial information on hand to support the biological appropriateness of proposing to list as endangered or threatened.

AGENCY: *Bureau of Land Management, Colorado*

BLMS - Designated by BLM State Director, as species of special concern, as evidence by biological imperilment and downward trend in population abundance and distribution on BLM public lands within state.

STATE: *Colorado Division of Wildlife*

SE - Endangered

ST - Threatened

SC - Species of Special Concern

GROUP: *Colorado Natural Heritage Program*

CNHP - Global Rarity Ranking is based on the range-wide status of a species.

G1 - Critically imperiled globally because of extreme rarity (5 or fewer occurences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction. (Critically endangered throughout its range).

G2 - Imperiled globally because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extinction throughout its range. (Endangered throughout its range).

G3 - Very rare or local throughout its range or found locally in a restricted range (21 to 100 occurrences). (Threatened throughout its range).

G4 - Apparently secure globally, though it might be quite rare in parts of its range, especially at the periphery.

G5 - Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

T - Taxa of subspecies or varieties, ranked on same criteria as G1-G5.

CNHP - State Rarity Ranking is based on the status of a species (relative abundance of individuals) in each state.

S1 - Critically imperiled in state because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extirpation from the state. (Critically endangered in state).

S2 - Imperiled in state because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extirpation from the state. (Endangered or threatened in state).

S3 - Rare in state (21 to 100 occurrences).

S#B - Refers to the breeding season imperilment of elements that are not permanent residents.

S#N- Refers to the non-breeding season imperilment of elements that are not permanent residents. Where no consistent location can be discerned for migrants or non-breeding populations, a rank of SZN is used.

SZ- Migrant whose occurrences are too irregular, transitory, and/or dispersed to be reliably identified, mapped, and protected.

[2] SPECIES CODES: Are from the BLM Wildlife & Fisheries Information System Data Element Dictionary: Plants: DED 2646 3/25/88; Vertebrates: DED 6554 2/25/88; and Fishes: DED 6803 2/25/88

[3] OCCURRENCE:

Indicates Resource Area of known occurrence using the following DE codes:

Craig District (01)	LS Little Snake (48),	WR White River (68),	KR Kremmling (78)
Montrose District (03)	UN Uncompahgre (48),	GN Gunnison (68),	SJ San Juan (88),
Canon City District (05)	SL San Luis (48),	RG Royal Gorge (58)	
Grand Junction District (07)	GJ Grand Junction (68),	GS Glenwood Springs (88)	

* - Not known to occur on BLM lands but should be considered.

** - Occurrence on BLM lands uncertain, past sightings have been recorded.

APPENDIX J

RANGELAND HEALTH WORKSHEET					
ATTRIBUTE	**CLASS I**	**CLASS II**	**CLASS III**	**CLASS IV**	**CLASS V**
RILLS	Rill formation is severe, well defined throughout most of the area at close intervals.	Rill formation is moderately active, well defined throughout most of the area at close intervals.	Active rill formation is slight at infrequent intervals, mostly in exposed areas.	No recent formation of rills; some evidence of past rill formation; old rills are blunted or muted.	Minimal evidence of recent or past formation of rills.
WATER FLOW PATTERNS	Flow patterns extensive and more numerous than expected; unstable with active erosion. Flow patterns connected.	Flow patterns more numerous than expected; deposition and cut areas common. Occasionally connected.	Flow patterns match what is expected for the site; erosion and deposition in flow pattern minor, but flow paths are not entirely stable.	Flow patterns match what is expected for the site. Little evidence of past erosion. Flow patterns are stable over the majority of the area.	Flow patterns are natural and stable and match what is expected for the site.
PEDESTALS CAUSED by WIND &/or WATER EROSION	Abundant active pedestaling. Most rocks and plants are affected; exposed plant roots are common.	Moderate active pedestaling. Some of rocks and plants are affected. Exposed plant roots are evident but not common.	Slight active pedestaling, most pedestals in flow paths, interspaces and/or on exposed slopes.	No indications of active pedestaling; some evidence of past pedestal formation, especially in flow paths and/or on exposed slopes.	Minimal current or past evidence of pedestalled plants or rocks.
BARE GROUND	Amount of bare ground much higher than expected for the site. Bare areas are large and are connected.	Amount of bare ground higher than expected for the site. Bare areas are large but are not connected.	Amount of bare ground slightly higher than expected for the site. Bare areas are moderate to small and clumped.	Amount of bare ground slightly higher than expected for the site. Size of bare areas are small.	Amount and distribution of bare areas matches that expected for the site.

RANGELAND HEALTH WORKSHEET (page two)

ATTRIBUTE	CLASS I	CLASS II	CLASS III	CLASS IV	CLASS V
GULLIES	Present with active erosion, vegetation is intermittent on slopes and/or bed. Nickpoints are present and new headcuts occurring. Downcutting of channel is apparent.	Present with indications of active erosion, vegetation is intermittent on slopes and/or bed. Headcuts are active. Downcutting of channel not apparent.	Present with few indications of active erosion, vegetation is intermittent on slopes and/or bed. Some headcutting is evident.	Present but stable; vegetation is well established on bed and slopes; no visual signs of active cutting, nickpoints, or bed erosion.	Drainage areas represented as natural stable channels.
WIND EROSION	Smooth wind blown soil surfaces dominate the site. Soil loss is excessive.	Exposed plant roots, aeolian deposits around plants, lee side of depressions and ridges. Plants show evidence of wind damage.	Plants show evidence of wind damage, minimal exposed roots; aeolian deposits around obstructions and the lee side of depressions and ridges.	No evidence of active movement of soil; aeolian deposits on lee side of obstructions, depressions and ridges.	Minimal evidence of active or past movement of soil by wind; aeolian deposits not evident.
MICROBIOTIC CRUSTS	Microbiotic crusts found only in protected areas.	Microbiotic crusts largely absent, occurring mostly in protected areas.	Microbiotic crusts evident under shrubs or other protected sites with a minor component outside protected areas.	Microbiotic crusts evident throughout the site, but disturbed, broken and irregular in occurrence.	Microbiotic crusts are largely intact throughout site. Matches that expected for the site in amount and distribution.

RANGELAND HEALTH WORKSHEET (page three)

ATTRIBUTE	CLASS I	CLASS II	CLASS III	CLASS IV	CLASS V
SOIL SURFACE	Surface organic layer rarely present, and then only in association with prominent plants or other obstructions	25-50% of the surface organic layer is no longer present. Variations in depth of the soil surface between vegetation and interspaces exceeds 25%	Not more than 25% of the surface organic layer is present. Variations in the depth of the soil surface between vegetation and interspaces is less than 25%.	Some evidence of past loss of surface organic layer. The soil surface is presently stable and no evidence of current surface organic layer loss.	Minimal evidence of surface organic layer loss. Variations between vegetation and interspaces matches that expected for the site.
INFILTRATION CAPACITY AND RUNOFF	Infiltration capacity has been severely decreased and surface runoff has been severely increased by heavy compaction, physical crusting, and/or by adverse composition change in the plant community.	Infiltration capacity is moderately reduced and surface runoff is moderately increased by soil compaction, physical crusting and/or plant community composition changes.	Infiltration capacity and surface runoff have been moderately affected as evidenced by minor compaction layers or physical crusts. Plant community composition not negatively affecting infiltration or runoff.	Infiltration capacity and surface runoff have been temporarily affected. Little evidence of compaction or physical crusts.	Infiltration capacity and surface runoff are normal relative to that expected for the site.
PLANT MORTALITY	Plant mortality and/or decadence in excess of that expected for the site is common.	Dead plants and/or decadence in excess of that expected for the site is readily apparent.	Some dead plants and decadence above that expected for the site is apparent.	Slight evidence of plant mortality and decadence above that expected for the site.	Plant mortality and decadence matches that expected for the site.

RANGELAND HEALTH WORKSHEET (page four)

ATTRIBUTE	CLASS I	CLASS II	CLASS III	CLASS IV	CLASS V
FUNCTIONAL PLANT GROUPS	Subdominant historical plant functional groups still dominate the site, but may be decreasing. Plant functional groups not present in the historic climax plant community are increasing and may become dominant.	Dominant historical plant functional groups no longer exist, a few individual species may persist. Subdominant historic plant functional groups dominate the site. Plant functional groups not present in the historic climax plant community may be increasing.	Dominant historic plant functional groups occur, but no longer dominate. Subdominant historic plant functional groups now dominate the site. Plant functional groups not present in the historic climax plant community may be appearing.	Dominant historic plant functional groups are decreasing, but still dominate. Subdominant historic plant functional groups are increasing.	Functional plant groups closely match that of the historic climax plant community.
LITTER DISTRIBUTION	Minimal woody and herbaceous litter accumulation evident.	Woody and herbaceous litter only in and under obstructions.	Litter distribution less than that expected for the site. Herbaceous litter concentrated in and around obstructions.	Litter distribution matches that expected for the site. Some herbaceous litter movement noticeable.	Litter distribution and movement by water or wind matches that expected for the site.
LITTER AMOUNT	Minimal litter accumulation evident.	Litter present, much less than expected for current conditions on the site.	Litter present, less than expected for the current conditions for the site.	Litter present, matches the current conditions for the site, but less or more than expected for the site.	Amount of litter is what is expected for the site.

RANGELAND HEALTH WORKSHEET (page five)					
ATTRIBUTE	CLASS I	CLASS II	CLASS III	CLASS IV	CLASS V
PLANT STRESS	Perennial vegetation is severely stressed.	Perennial vegetation is moderately stressed.	Perennial vegetation shows signs of short term stress.	Perennial vegetation showing few signs of short term stress.	Perennial vegetation showing minimal signs of any stress.
PRODUCTION	Productivity less than 20% of potential production.	Productivity 20-40% of potential production.	Productivity 40-60% of potential production.	Productivity 60-80% of potential production.	Productivity exceeds 80% of potential production.
INVASIVE PLANTS	Invasive plants dominate the site.	Invasive plants are common throughout the site.	Invasive plants are scattered throughout the site.	Invasive plants are present only in disturbed areas.	Invasive plants are not present on the site.
RECRUITMENT OR REPRODUCTION	Ability of plants to produce seed or vegetative tillers is severely reduced.	Ability of plants to produce seed or vegetative tillers is reduced.	Ability of plants to produce seed or vegetative tillers is somewhat limited.	Ability of plants to produce seed or vegetative tillers is only slightly affected.	Ability of plants to produce seed or vegetative tillers is not affected.

APPENDIX J

RANGELAND HEALTH WORKSHEET (page four)

ATTRIBUTE	CLASS I	CLASS II	CLASS III	CLASS IV	CLASS V
FUNCTIONAL PLANT GROUPS	Subdominant historical plant functional groups still dominate the site, but may be decreasing. Plant functional groups not present in the historic climax plant community are increasing and may become dominant.	Dominant historical plant functional groups no longer exist, a few individual species may persist. Subdominant historic plant functional groups dominate the site. Plant functional groups not present	Dominant historic plant functional groups occur, but no longer dominate. Subdominant historic plant functional groups now dominate the site. Plant functional groups not present in the	Dominant historic plant functional groups are decreasing, but still dominate. Subdominant historic plant functional groups are increasing.	Functional plant groups closely match that of the historic climax plant community.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

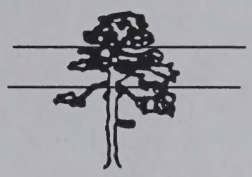
Appendix K

MISTLETOE RATING

When damage code 24 (dwarf mistletoe) is entered the mistletoe severity must berated. Compute mistletoe damage on sawtimber, poletimber, and saplings. Mistletoe on seedlings generally occurs on the bole; rate it as 06.

Rate the degree of infection as follows:

Step 1 - Divide the crown into third.



Step 2 - Score each third.

0 = No infection
1 = Light infection; one-half or less of total number of branches infected, no prominent brooms.
2 = Heavy infection; more than one-half of the branches infected or one or more prominent brooms.

Step 3 - The infection rating equals the sum of the three scores.

Example: Top third score = 1
Middle third score = 3
Bottom third score = 3
Total score = 5

NOTE: The maximum rating allowed is 6.

Step 4 - Record the rating in the severity column of the inventory form.

Appendix K

MISTLETOE RATING

When damage code 24 (dwarf mistletoe) is entered the mistletoe severity must be rated. Compute mistletoe damage on sawtimber, poletimber, and saplings. Mistletoe on seedlings generally occurs on the bole; rate it as 03.

Rate the degree of infection as follows:

Step 1 - Divide the crown into thirds.

Step 2 - Score each third.

0 = No infection
1 = Light infection, one-half or less of total number of branches infected, no prominent brooms.
2 = Heavy infection, more than one-half of the branches infected or one or more prominent brooms.

Step 3 - The infection rating equals the sum of the three scores.

Example: Top third score = 1
Middle third score = 2
Bottom third score = 2
Total score = 5

NOTE: The maximum rating allowed is 6.

Step 4 - Record the rating in the severity column of the inventory form.